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THE EARTHQUAKE RIFT OF 1906

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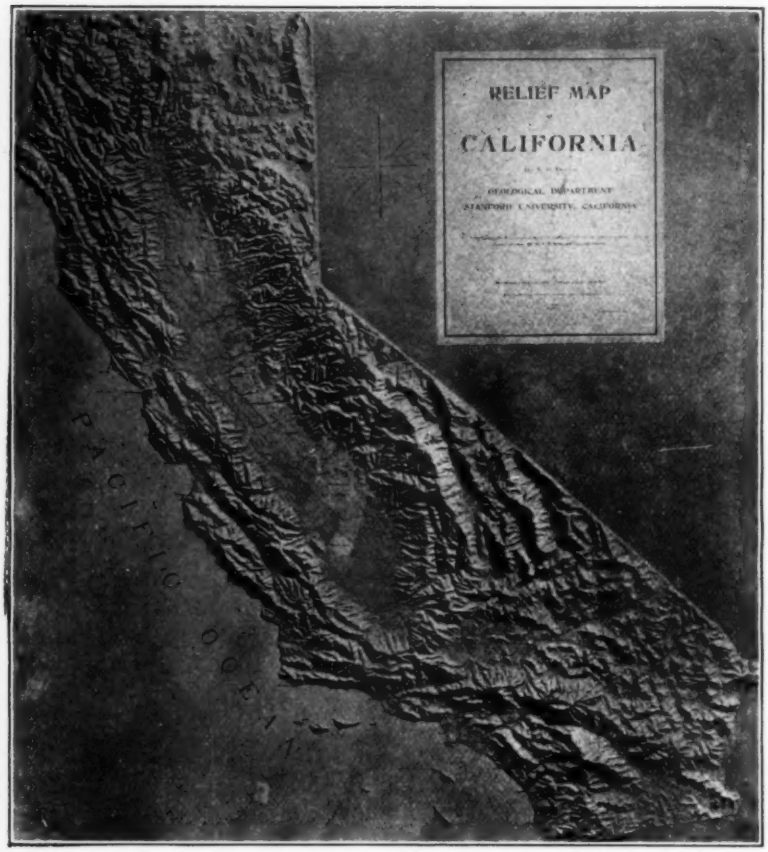
THERE are two sets of disturbances which shake the crust of the earth and therefore go by the name of earthquakes. Eruptive earthquakes are explosions, usually of steam, about a volcano. Tectonic earthquakes are breaks in the overloaded or overstrained crust of the earth, and, for the most part, have nothing to do with the steam vents we call volcanoes. To the last class most earthquakes belong, certainly almost all that have been felt within the United States.

Again, under the name of earthquake we include two very different sets of phenomena, the one the rock-rift or fault, which is the disturbance itself, the other the spreading or interfering waves set in motion by the parting, shearing and grinding of the sundered walls of rocks in the earthquake fault. It is the jarring waves extending in widening and interfering circles which do the mischief to man and his affairs. It is the rift of rock which sends these waves forth on their blind mission of confusion or destruction.

In every tectonic earthquake there is somewhere a fault or rift of rock, with some sort of displacement, permanent or temporary, of the relations of the two sides: In extreme cases, this break extends for miles in a straight line, breaking the surface soil and passing downward to a depth which can be only guessed at, five or ten miles perhaps, perhaps as far down as the crust is rigid. There are undoubtedly destructive earthquakes in which the soil is not broken over the rift of rock, but as a rule, in violent disturbances, the crack comes to the surface, breaking through the overlying soil. In all severe earthquakes there are, moreover, breaks or fissures in the earth having no connection with the fault itself. These are slumps or landslides, and geologically

they signify but little. They mean simply that loose soil has been shaken down. They do not go down into the underlying rock. From the true earthquake crack they may usually be known at once, because their course is determined by the topography. They are not straight. The true earthquake rift moves on in straight lines, broadly speaking, careless of topography. But topography is not careless of the earthquake rift. On either side of it, for perhaps hundreds of feet, the

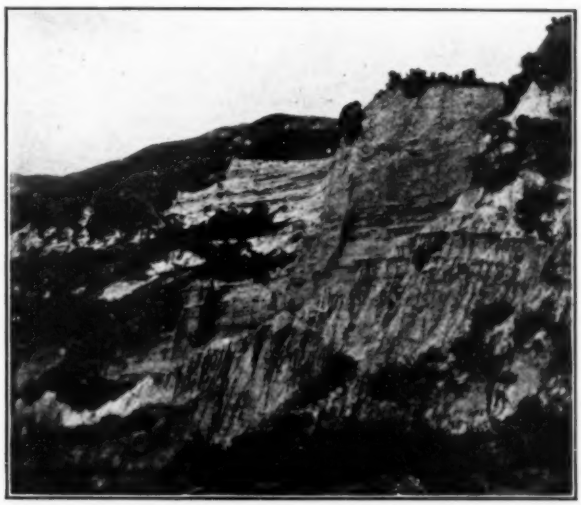


RELIEF MAP OF CALIFORNIA.

rocks are crushed to flinders by the impact and grinding of the opposed walls. An old fault is therefore marked by an excess of erosion. A valley or saddle marks its general course. Streams choose it for their basins, and when it crosses a mountain the softened rock yields to form a saddle or other form of depression. For these reasons, an earthquake fault is often marked in California by successions of dairies and of reservoirs. The valleys thus formed are fertile and well watered. For the most part, in much-faulted regions, such as form the rim of

EARTHQUAKE RIFT, as it comes up from the sea at Point Arena. Mendocino County.

the Pacific, each earthquake rift follows the line of an old fault, and the original break goes back to the mountain-making periods of Tertiary times. The California earthquake of 1906 follows the axis of an ancient break, the 'Portolá-Tomales fault,' or 'San Andreas fault,' first studied, so far as I know, by Dr. John C. Branner in 1892. In this fault hundreds of thousands of earthquakes, large and small, have



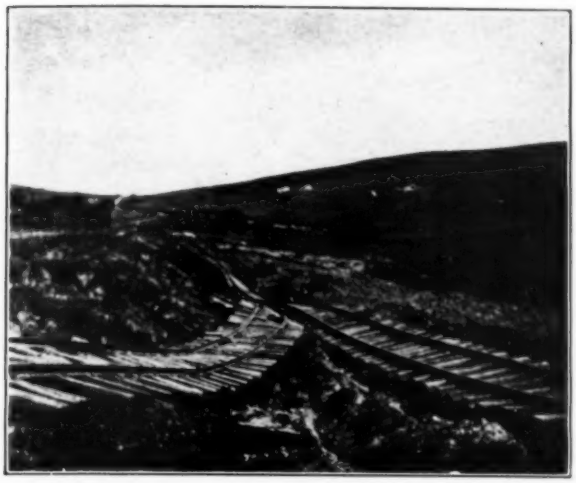
FISSURE AND LANDSLIP, SAN JACINTO VALLEY, 1897.

preceded the recent one. In it the aggregate displacement horizontally has been very great, and the aggregate vertical displacement as shown by the rock strata on either side of it exceeds half a mile.

It is the purpose of this article to trace the earthquake rift of April 18, 1906, across the map of California. The accompanying photograph of a relief map by Dr. Noah Fields Drake will show the topography of the state. In California there are multitudes of valleys of various kinds. Those formed by water and ice surface erosion are variously curved and ramified. Such are the mountain cañons of the west flanks of the Sierras. Those valleys formed or marked by earthquake cracks have almost invariably straight axes. These extend in general toward the north-northwest, more or less distinctly parallel with each other, and often intersected by cross-faults.

Examples of faulted valleys are the great valley of the Sacramento and San Joaquin, the Santa Clara Valley, San Francisco Bay, with the Valley of Santa Rosa, Eel River Valley, the Santa Catalina Channel, Owens River, the San Jacinto Valley and many others. A cross-fault extends from Monterey Bay up the valley of the Pájaro River. In some of these faults earthquakes have taken place in historic times, in others no break has been noted save that recorded in the rocks. Dr. Branner has compared a fault to a break in a bone. It represents a weak place which will give in a time of strain. On the other hand, if not freshly broken, it will tend with time to heal. A broken bone

ALDER CREEK BRIDGE, MENDOCINO COUNTY. The earthquake rift is near the middle of the picture.



TOMALES, MARIN COUNTY. The North Shore Railroad and the earthquake rift.

will be naturally renewed. A faulted rock bed will be cemented in the course of ages of pressure and of cementation.

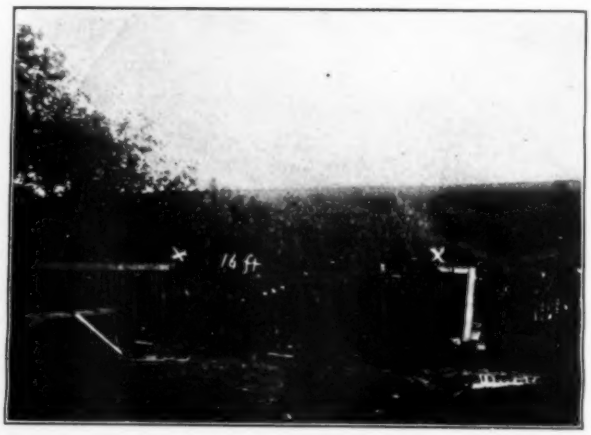
The most interesting of these breaks in California is that recorded as the Portolá-Tomales fault. Its course can be plainly traced on the relief map. It enters the shore near the mouth of Alder Creek and near the low headland called Point Arena, in Mendocino County on the north, and runs to Chittenden, on the Pájaro River, in Monterey County, on the south. The line is almost perfectly straight, and its course and direction can be determined by placing a ruler on the map, using the line of Tomales Bay as an axis. This long, narrow, straight inlet is a resultant of past earthquakes, probably beginning in Tertiary times. It is bounded on the west by mountains which have their origin in some ancient upward thrust of the walls on the west side of the ancient fault.

On the eighteenth of April the trouble began in the sea. Just where, we may find out later. We know that the center is in the sea, because where the rift enters the land it was broader and its effects more violent than at any other point along its extent. As the rift can be traced for 192 miles across the land to the southward from Point Arena, it is safe to say that it goes as far to the northward under the sea. A steamer crossing it the moment of the earthquake, off Mendocino, ninety miles to the northward of Point Arena, bears witness to this fact. The captain thought that he had struck a raft of logs, so fierce and hard were the shocks of the waves in the water. The movements were short, quick and violent, not forming a tidal wave, but a strange choppy sea. For the time being all rollers and surf were broken up. Off the bold headland of Cape Mendocino is a deep sub-

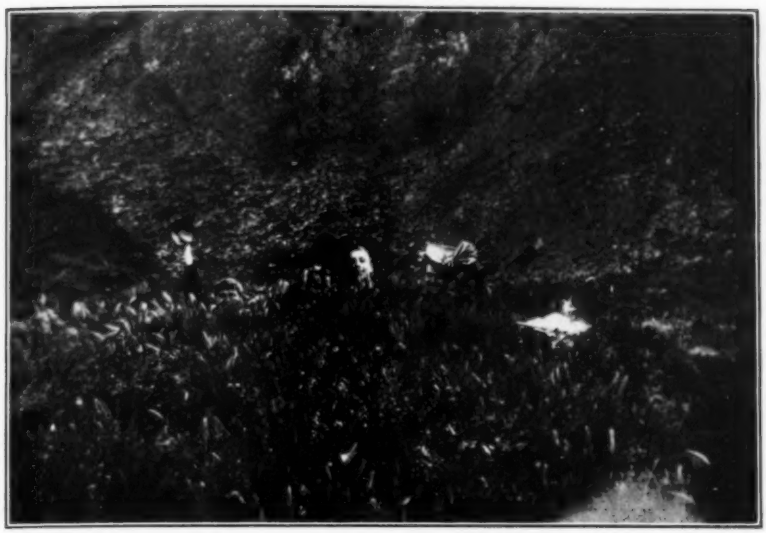
marine valley, to the west of which is a high mountain which does not rise to the surface of the ocean. In the channel between the cape and the submerged mountain the earthquake rift may be supposed to run. In this channel numerous earthquake shocks have been recorded by different passing vessels. If not itself a center of disturbance, it records the line along which great disturbances have frequently passed.

The rift struck the land at the mouth of Alder Creek, above Point Arena. It crept over the hill as a deep furrow in the black, sticky adobe, veering a little to left or right according to the resistance of the soil, but always keeping in a straight line in its general direction. It may be imagined as a sort of devouring dragon, leaving its trail on the hills and destroying the works of man wherever it passes. It is hard in following its course, not to think of it as endowed with a sort of wicked life. Its movement is properly from north to south, but the opening of the great fault seems to have been really instantaneous. It took place at 5:13 A.M. and the waves lasted forty-seven seconds. It may be noted in passing that the complication of the waves at any one point was mainly due to the great length of the rift. A point immediately near the crack felt mainly the first great shock, its wave and the return wave. A point farther away felt the wave and its return jolt, followed at once by waves from farther to the north and farther to the south, these waves becoming more and more opposed to one another. The waves would then augment, neutralize, override and otherwise modify one another, the final result being the violent twisting motion, the most remarkable trait of the latter portion of the earthquake in question.

Coming over the first ridge, from the sea, the rift passed under the long bridge over Alder Creek. The land on the west side of the bridge



POINT ARENA. Picket fence was in one continuous line. Photograph shows short section put in to fill up offset by land on the west side.



LAND SLIP AT SOBRANTE.

was jerked sixteen feet to the north; or that on the east sixteen feet to the south—only a careful re-survey of the region can tell us which. Or it may be that both sides went to the northward, but the west side pulled away, distancing the other by sixteen feet. In any case, the bridge was torn to splinters, and the crack went on, always the west side some sixteen and a half feet to the northward, though the sticky soil tends to lag back, and not every place shows the maximum of sheering or horizontal displacement. Passing under a barn, the rift tore it to splinters. The spreading wave displaced or destroyed most of the

LAND SLIP AT SOBRANTE

houses in the villages of Manchester and Point Arena, wrecking the magnificent lighthouse of solid masonry on the Point itself. In low ground the rift formed successions of little ponds. On hillsides the lower side of the crack fell away like a drivelling lower lip, leaving an open chasm, ten to twenty feet in apparent depth. On level hard ground the soil like the rock below closed with a snap a little tighter than it was before. Line fences were broken and sheered from sixteen to twenty feet. Lines of trees met with similar readjustments. In Mendocino County the horizontal displacement is about sixteen feet. In Marin County, where exactly measured, it is sixteen feet and seven inches. Southward it becomes less. In San Mateo County it is six to eight feet, and at the Pájaro Bridge at Chittenden, where the open fault ceases, the western pier was moved northward about eighteen inches. This shifting of position, evident along the line of the crack, seems to have included the whole region, mountains and valleys, through which the crack passes. Either the region to the westward with the Santa Cruz Mountains and the mountains called Sobrante de la Punta de los Reyes have been stretched out toward the northward or else the region on the east side, including most of California, has been correspondingly humped up. It is impossible at present to say which is the fact, perhaps both. The vertical displacement is small. To the north of San Francisco the west side has been raised two or three feet. To the southward the slight relative change in elevation—two or three feet—is in favor of the east side.

MARSHALL HOTEL, THROWN INTO TOMALES BAY.

EARTHQUAKE CRACK IN COUNTRY ROAD FROM OLEMA TO POINT REYES.

The rift left the pastures of Point Arena, passing up Gualala River, always in a straight line, making havoc among the redwood

EARTHQUAKE RIFT, FREEMAN'S RANCH, NEAR TOMALES BAY.

trees, thence into the sea, where it runs close along the coast, past Fort Ross, throwing down everything movable in this and other towns. It then crosses Bodega Head and again falls into the sea, where it passes up the axis of Tomales Bay. At the head of the bay its course through the tules or bulrushes looks like a swath through a grain

EARTHQUAKE RIFT, FREEMAN'S RANCH.

field. Through this region (Marin County) the shock was very violent, and numerous cracks parallel with the main crack in the bay extended along the shores. In the town of Tomales, much and varied mischief was done. The parallel cracks toyed with miles of the North Shore Railroad between Tomales and Point Reyes. At Marshall the hotel was thrown bodily—and upright—into the bay, the boarders unharmed; and at aristocratic Inverness, on Tomales Bay, three summer cottages suffered the same fate. A fisherman in the bay reports that the waters receded, leaving his boat in the mud. Afterwards they came back in a 'great wave, which looked a hundred feet high, but which was probably not more than ten.'

At Point Reyes Station at the head of Tomales Bay the 5:15 train for San Francisco was just ready. The conductor had just swung on when the train gave a great lurch to the east, followed by another to the west, which threw the whole train on its side. The astonished conductor dropped off as it went over, and at sight of the falling chimneys and breaking windows of the station, he understood that it was the *Temblor*. The fireman turned to jump from the engine to the west when the return shock came. He then leaped to the east and borrowing a kodak he took the picture of the train here presented.

Paper Mill Creek runs past the same village, a considerable stream, noteworthy lately from the successful stocking with king salmon. The two banks of the stream were forced toward each other so that the length of the bridge was shortened by about six feet and the bridge was correspondingly humped at its north end, an arch about six feet high being forced up.

From Point Reyes Station (at the base of the peninsula also called Point Reyes) the earthquake rift passed along the Inverness Road to Olema, where all the houses not standing on rock foundation were thrown from three to six feet to the westward, toward the crack itself.

Skinner's Ranch is a large dairy near Olema. The house stands near the road, a dairy house some thirty feet to the south of it, and a large barn with cowyard just behind that. A row of large cypress trees stood just before the house on the roadside, between them and the house a little rose garden, to the south of these, opposite and partly behind the dairy, a group or row of large eucalyptus trees.

The earthquake rift passed directly in front of the house, between the buildings and the road. All that stood to the westward of the crack was violently jerked to the north a distance of sixteen feet seven inches, or it may be that the east side moved an equal distance to the south. If Mr. Skinner had chanced to look at the right instant he would have seen the whole row of cypress trees file past his window to take their station in front of the dairy, taking the rose garden with them. A few raspberry bushes came from farther north to take,

partly, the place of the roses. The eucalyptus trees in front of the dairy moved on to a position opposite the barn, and one detached from the others and to the westward of the crack was left near the head of the line instead of at its foot. The crack passes obliquely under the barn, entering it at the northwest corner and leaving it at the middle of its posterior or southwest side. The barn remained intact, thanks to its weak foundation, for the east side pulled loose from the ground, and the barn went northward with the west side. Sixteen and one half feet of its former foundation at the southeastern corner is exposed. A driveway under the barn is divided in the middle. You pass in on the east side, the western half is sixteen and one half feet to the north

TRAIN OVERTURNED BY EARTHQUAKE, POINT REYES STATION, MARIN CO., CAL.

of the entrance and completely blocked in the middle. Under each of the east windows of the barn stood a pile of manure. Each pile is intact, sixteen and one half feet south of the window to which it belongs. The people at the ranch were milking at the time of the shock. Each man and cow was thrown to the ground and it took two hours to get the frightened cattle back into the 'corral.' The stone steps to the dairy, on the east side of the crack, now stand sixteen feet seven inches to the southward of the door to which they led. About Skinner's, line fences and water pipes crossing the fault were broken, a break of sixteen and one half feet being left in each case, the west side of the fault in all cases more or less overriding the other. In the matter of line fences interesting legal problems are raised. Were the

EARTHQUAKE RIFT. OLEMA.

farms on the west stretched sixteen and one half feet or those on the east side crowded together to the same amount? If either, who stands the loss and what store can be set on ancient landmarks?

Next to the Skinner Ranch is the Shafter Ranch. Here the houses and barns are on the east side of the crack, but the transposition of

SKINNER'S RANCH, OLEMA.

roads, trees and fences was the same in kind. The rift passed through the corral, and one of the astonished cows dropped into it, soon falling deeply till only rump and tail were visible. The hysterical dogs barked at her, the water came into the rift, and the dairymen, doubtless with a sense of the impotence to struggle against fate, buried her in the grave from which they could not rescue her.

Crossing the valley the rift split a small hill, throwing down four large spruce trees, all of which fell at right angles to the crack. A very large oak tree standing on level ground was shoved violently, still standing, sixteen and one half feet to the southward into the base of the riven hill, or perhaps the western half of the hill was shoved violently about the tree. Dr. G. K. Gilbert seems to think it probable that both sides partook in the motion.

On through the valley of Olema went the rift, past more dairies, but leaving their buildings altogether to the east. Crossing the road above Bolinas, the two sides of the highway are rudely separated. Reaching Bolinas Bay, the rift is visible in the mud at low tide, and good authority reports the sea-bottom to the westward, along Duxbury Reef, to be raised two or three feet. The gatherers of abalone shells venture out into regions of sea-bottom formerly inaccessible at the lowest tides. On the east side of Bolinas Bay the clams are hopelessly buried. At Bolinas the pretty Flagstaff Inn was thrown into the sea and completely wrecked. The crack again enters the sea, passing across the entrance to the Golden Gate five or six miles west of the center of San Francisco, and giving to that breezy and joyous town a jolt which will live in history, but from which the fine-spirited people will recover long before the world at large will clearly understand what their experiences have really been. The rift reached the shore again at Mussel Rock to the southwest of San Francisco. Here the cliff was hurled down, a gradual incline was made a steep one and four thousand feet of newly graded railroad was thrown into the sea. It passed up the narrow valley of San Andreas, not harming the reservoir, but wrecking all the water mains entering San Francisco from the great reservoirs, Crystal Springs, San Andreas and Pilarcitos. The dam of the Crystal Springs reservoir, across the fault line, was so well built that the visible crack passed around it along the bank by its side, returning afterwards to its former direction. The bleak and boulder-strewn saddle called Cañada del Raymundo, scarred by previous earthquakes, was then passed, and beyond it the narrow, fertile valley, Portolá, named for the first governor of California, the discoverer of San Francisco Bay. The crack runs along the base of the Sierra Morena, four to five miles west of Stanford University, to the head of Portolá reservoir; then ascends in a cañon to a saddle on the summit, connecting two parallel ranges, Monte Bello to the east and

Castle Rock to the west. Down from the saddle between these runs Stevens Creek (Arroyo de San José de Cupertino) and down this creek went the earthquake crack, tearing up the road behind it, and throwing down landslides from every steep slope. Stevens Creek is made up from the union of two streams which meet from opposite directions. The crack descends the one and remounts impartially in the valley of the other. Both streams follow old earthquake tracks. Over another saddle the crack goes to Saratoga Creek. Across it and over another saddle it follows Campbell Creek, draining its reservoir. Thence it crosses obliquely the valley of Los Gatos Creek, over the hills of which Bret Harte wrote—

> The ridges 'round Los Gatos Creek
> Arched their spines in a feline fashion,

in the earthquake of 1818. Into this creek, from the Feely ranch,

EARTHQUAKE RIFT, MORRILL'S RANCH, SKYLANDS, SANTA CRUZ COUNTY.

some ten acres of land was thrown in a great landslide. At the head of the creek is the long tunnel which cuts under the saddle, from Wright's to Laurel. This tunnel has been the source of endless trouble since it was made, and for the reason that the rock in the mountain through which it passes is made up of minute chips of rock. No wonder, for the earthquake crack follows the mountain ridge, which is here narrow and low. It cuts tunnel and railroad track at right angles, and every earthquake disturbance is sure to make matters worse. Already forty feet of crushed rock has fallen from above what was the

EARTHQUAKE RIFT, MORRILL'S ORCHARD, SANTA CRUZ COUNTY.

roof of the tunnel. On the hill above the tunnel is Morrill's fruit ranch. The earthquake ripped its way through the orchards, shifting the rows of trees six to eight feet and treating roads and fences in the same reckless fashion. The large hospitable Morrill farmhouse stood partly over the track and was split in two and utterly ruined. Farther on at Skylands, on the ridge of the mountains, Fern Gulch was filled with wreckage; redwood trees four and five feet through, two or three hundred years old, were snapped off like whip-lashes. The rift crossed Hinckley's Gulch at right angles. This is a narrow gorge about a hundred feet deep, in which stood the large Loma Prieta sawmill. The gorge was filled by landslips thrown from both sides. The mill was completely buried, with nine mill hands, and a redwood tree over a hundred feet high was set erect and unhurt over the place where the mill stood. The bodies of six men were recovered. One of these, the foreman, was found erect, smothered in mud, but standing with extended arms and limbs in the act of running from the mill. With him, equally erect and in the act of running, was the body of a Siberian mastiff. Their position marked the meeting point of the two walls of

INVERNESS ROAD, NEAR OLEMA, MARIN COUNTY.

WRECK OF LOMA PRIETA SAW MILL, HINCKLEY'S GULCH, SANTA CRUZ COUNTY.

the cañon. The crack went on across the hills, always in the same direction, southeast by south, till it came to the Chittenden Ranch in the Pájaro Valley. Here it tore off the hillside, destroying the highway at its base; then descended to the Pájaro River, shifting a pier of its railroad bridge about eighteen inches to the northwest. Here it met the Pájaro cross-fault. But here the straight line from Point Arena came to an end. A series of short breaks creeps off to the southeast, ending two miles southwest of San Juan, the last act being the final, almost complete, wreck of the beautiful and venerable Mission of San Juan Bautista.

That the oblique crack from Chittenden, famous as an 'earthquake ranch' of earlier times, to San Juan, is part of the original rift, is not

SITE OF LOMA PRIETA SAW MILL, COVERED TO THE DEPTH OF 125 FEET.

clear. It may be that this is part of the Pájaro cross-fault. The original Portolá-Tomales fault, if continued in a straight line from Chittenden, would pass along the flanks or the foot of the Gavilan mountains to Priest Valley, fifty miles to the south-southeast. Beyond Priest Valley is a well-marked earthquake crack, which opened in the earthquake of 1868, and in earlier times. This extends through desert land in the same direction, its course being the axis of the Cholame Valley and the uninhabited desert sink known as Carisa Plain. This old rift extends at least one hundred and forty miles beyond Chittenden to Monte Pinos in the north edge of Ventura County. This whole fault from Point Arena to Monte Pinos is clearly a single break, but only 192 miles of a possible 330 were opened in the earthquake of 1906.

But while the surface break seemed to end at Chittenden, it seems probable that the rift in the rocks below extended much farther. At Priest Valley, fifty miles along this line, the shock was violent, while at localities ten miles or more to the east and west of the line, as at Lone Oak or the Pinnacles, it was very little felt. In Priest Valley chimneys and shelving were thrown down, buildings badly shaken and the contents of a country store impartially scattered over the floor, the shock being apparently about as severe as in San Francisco.

With the opening of the great rift it is conceivable that faults in the neighborhood should also be affected. There is evidence (most of which the writer has not examined) of the opening of a parallel fault behind Cape Mendocino. This seems to have passed across the base of the cape, cutting across the smaller headland called Point Delgada, losing itself in the Sonoma Valley to the southwest of Santa Rosa. There are distinct traces of it across Burbank's famous orchard at Sebastopol. Here on a slope lines of fruit trees were shifted, a well was moved bodily three or four feet, and a crack about one fourth mile long extended across a neighboring field, its direction parallel with that of the Tomales rift. Other similar cracks open at intervals on the road toward Point Delgada. The extreme violence of the shock in Santa Rosa perhaps indicates its nearness to this second rift, as the Tomales rift caused little damage in other towns equally far away. Dr. G. K. Gilbert takes a somewhat different view of this case. He seems to regard this Point Delgada crack as part of the great Tomales-Portolá rift. In his map (POPULAR SCIENCE MONTHLY, August) Dr. Gilbert marks the great rift as swinging eastward in a curve across Point Delgada and to the eastward of Cape Mendocino between that headland and Humboldt Bay. It seems to the present writer far more probable that the Point Delgada fault is a separate rift, parallel with the main rift, and similar to it, except that it is a little less violent. There is some evidence that a fault line at the foot of San Francisco

Bay opened for a short distance to the southward of Milpitas. But the soft soil in that region was filled with slumps and cracks due to the shaking down of loose deposits, and one could not be sure that the actual fault in the rocks was really disturbed. The same remark applies to the breaks at San Bruno about ten miles south of San Francisco in marsh deposits over the recognized San Bruno-Lake Merced fault. It is readily conceivable that a great disturbance like the one in the main fault might be accompanied by similar breaks in parallel or associated faults.

The chief center of disturbance in the earthquake of 1906 would seem to be in the sea. The evidence for this lies in the fact that at the point where the fault enters the land near Point Arena the displacement is greater than anywhere else. As the land fault is traceable for nearly two hundred miles to the southward, it is reasonable to suppose that the sea-bottom is broken for at least an equal distance to the northward. The point of earthquake disturbance off Cape Mendocino has been frequently noticed in the past, and this is in a right line with the rest of the fault. It is possible that the center of trouble is located in the valley between Cape Mendocino and the off-lying submarine mountain.

There is also another possibility, very remote perhaps, but still worth considering, that is, the connection between this rift and the disturbances about the islands of St. John Bogoslof, in Bering Sea. In the year 1768, to the north of the island of Umnak and about seventy miles northwest of Unalaska, a large island arose from the sea, in an earthquake disturbance. This island, Old Bogoslof, recorded by Captain Cook, was, as the present writer recalls it, about two miles long and fifteen hundred feet in height. In 1796, in another seismic disturbance, an addition was made to this island. In 1883 (October 28) a second island, of about the same size, arose, also from the sea, to the northward of the first. A photograph in my possession, taken in 1892 by Mr. N. B. Miller, of the steamer *Albatross,* shows this island, still hot and steaming. In 1896, when I visited it, it was apparently cold. These islands are supposably parts of the sea-bottom with a backing of melted rock, forced to the surface by pressure. On October 30, 1883, a severe earthquake was reported off Cape Mendocino. If on a globe one extends the axis of the Portolá-Tomales-San Andreas fault as far as Alaska, it would not fall far from these Bogoslof Islands. This fact suggested to the writer that possibly the earthquake of 1906 meant the birth of another Bogoslof. And it appears that this indeed was the case. The scanty reports which have reached us from the visit of the *Albatross* in May tell us that a third Bogoslof 'five times as large as either of the others' and between them, has arisen, and according to Captain Dirks, who re-

ported the matter at Unalaska, the water was so hot that a vessel could not approach within five miles of the island. It is conceivable that the great earthquake rift has its center in the area of weakened sea-bottom occupied by the Bogoslofs. It is possible, even probable, that the coincidence of time does not show any real connection between Bogoslof and the earthquake of 1906. Against the connection may be urged the great distance, the great depth of most of the intervening sea, and the alleged facts that the seismograph at Sitka showed a shock from the south, while that at Tokyo indicated waves from the east. It is also stated that no shock was felt at St. Paul, St. George or Unalaska, but that a great shock was felt at Unimak. Unimak, like Unalaska, lies to the east of the supposed line of the fault. In any case, the birth of the third Bogoslof is a matter worthy of thorough investigation, and its approximate coincidence in time with the earthquake in California is very suggestive.

The earthquake of 1906 is receiving the most thorough study possible, and in such a way as to give promise of important practical results. The many previous earthquakes have been recorded, but their most essential feature, the location and extent of the causing fissure has rarely been indicated. In the records we read again and again that 'fissures opened in the ground,' but whether these were rifts in the crust or mere slumps of soft ground as a rule has escaped attention. The great earthquake of 1868 opened rifts at intervals from Tomales Bay to Carisa Plain, and also a fissure on the east side of San Francisco Bay, where a straight crack about ten miles long extended from Haywards toward the south. One side of this rift showed a lateral displacement of about four feet. To this short rift, rather than to the Portolá-Tomales fissure, the shock in San Francisco in 1868 may have been due. The shock in that year was more violent in Oakland than in San Francisco and most violent about San Leandro and Haywards, to the south of Oakland. It is conceivable that the shock of 1865, having its center in the Portolá fault, not far from San Francisco, gave that city a degree of immunity in 1868. Other destructive earthquakes, as recorded by Holden ('Catalogue of Earthquakes on the Pacific Coast, 1769 to 1897') are as follows:

1800. This earthquake was severe about San Juan Bautista, but whether in the Portolá fault or the Pájaro fault is not clear.

1812. This earthquake wrecked the mission of San Juan Capistrano in southern California, and was felt along the line of the southern missions. It had its center possibly in the Santa Catalina Channel.

1818. This earthquake injured the mission of Santa Clara; hence it may have been along the Portolá fault.

1836. This was said to be similar to the shock of 1868, its center along the Portolá line; 'great fissures were made in the earth.'

1839. This was severe from Redwood to San Francisco, 'a great fissure opened to Mission San José.' It was probably also in the Pájaro fault.

1857. Sacramento to Fort Tejón, San Bernardino and Fort Yuma. At Fort Tejón 'a fissure 20 feet wide and 40 miles long: the sides came together with such violence as to make a ridge ten feet wide and several feet high.' Fissures at San Bernardino.

1865. This was a smart shock from San Francisco to San José, apparently along the line of the Portolá fault. The severity of this earthquake, as suggested above, may have mitigated the local severity of the earthquake of 1868, which was in the same rift, but not so severe in this part of it.

1867. This was violent disturbance about Klamath Lake. A great crack said to have opened in Siskiyou County, but the locality is not recorded.

1868. A very severe earthquake, there being a rift on the east side of the bay, as also at Olema, in the Santa Cruz Mountains and for over a hundred miles from Cholame through the Carisa Plain.

1872. Owens River, Inyo County. Fissure at Big Pine 50 to 200 feet wide, 20 feet deep, extending 50 miles or more. Numerous shocks, very violent, these preceded by weaker shocks for a year or more.

1890. Mono Lake, similar disturbances.

1892. Vacaville, Winters, etc., extensive local disturbances, the fissures not traced, but said to have been along Rio de los Putos on the west side of the valley of Solano and Yolo.

1897. San Jacinto Valley, with a notable fissure, the details not at hand.

To these might be added the vigorous single jolt of 1893 in the San Fernando Mountains, which did little harm because occurring in an uninhabited region. The writer was at Saugus at the time, and noted the fall of trees and the flinging of rocks down the mountain-side. There seems to have been but a single wave, which would have done great injury in a populous district. It came from a short fissure in Pico Cañon.

Since the earthquake of 1906 many small earthquake waves have followed, evidently harmless details in the process of adjustment. Looking over Holden's record, we see that many small disturbances have taken place along the line of the great fault in question, besides the great earthquakes of 1868 and 1906 and the lesser ones of 1800, 1818, 1836, 1839, 1865 and 1868.

In 1808 there were twenty-one shocks at the Presidio of San Francisco. In 1812 the shocks caused a tidal wave in the bay extending up to the plaza. In 1813 or 1815 'all the buildings' in Santa Clara Valley were shaken down. There were not many and all these were of adobe or sun-dried brick. In 1851, a sharp shock in San Francisco. In 1852, a shock at San Francisco, with a fissure on the San Bruno fault, through which Lake Merced drained into the sea.

1853. Heavy shocks near Humboldt Bay.

1856. Severe shocks at San Francisco, the water in the bay sank two feet.

1863, 1864. A sharp shock at San Juan Bautista.

1890. Sharp shock along Portolá fault. The Pájaro bridge had a pier shifted 18 inches, as in 1906. The same crack opened at Chittenden, and the main arch in the Mission Church at San Juan Bautista was injured. A rift opened in the soil from Chittenden to San Juan as in 1906.

It is evident that minor disturbances occur along all the fault lines in California and that but one break comparable to that of 1906 has taken place within historic times in California. This was the earthquake of 1868. This was far less violent than that of 1906, along the San Francisco peninsula, although extending farther to the south than the other. It may be remembered that the population of the region is now much greater than in 1868, and in like manner, the possibilities of mischief on the part of earthquakes has been correspondingly increased. The danger from earthquakes itself is relatively a small matter, but it should be considered in the building arrangements of regions where such disturbances are likely to recur. It is as easy to make buildings virtually earthquake-proof as water-proof, unless standing directly over the fault itself. In this connection we may close with the pertinent words of the engineer, William H. Hall, of San Francisco: "The earthquake has put a definition on the word *sham,* which seems positively cruel. It has established a value on the solid foundation and genuine superstructure which is indeed ennobling."

It would redound to the moral and spiritual elevation of any community to be assured of a smart shock at intervals and of a real *temblor* once in each generation.

THE VALUE OF SCIENCE

By M. H. POINCARE
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Chapter II. The Measure of Time

I.

So long as we do not go outside the domain of consciousness, the notion of time is relatively clear. Not only do we distinguish without difficulty present sensation from the remembrance of past sensations or the anticipation of future sensations, but we know perfectly well what we mean when we say that, of two conscious phenomena which we remember, one was anterior to the other; or that, of two foreseen conscious phenomena, one will be anterior to the other.

When we say that two conscious facts are simultaneous, we mean that they profoundly interpenetrate, so that analysis can not separate them without mutilating them.

The order in which we arrange conscious phenomena does not admit of any arbitrariness. It is imposed upon us and of it we can change nothing.

I have only a single observation to add. For an aggregate of sensations to have become a remembrance capable of classification in time, it must have ceased to be actual, we must have lost the sense of its infinite complexity, otherwise it would have remained present. It must, so to speak, have crystallized around a center of associations of ideas which will be a sort of label. It is only when they thus have lost all life that we can classify our memories in time as a botanist arranges dried flowers in his herbarium.

But these labels can only be finite in number. On that score, psychologic time should be discontinuous. Whence comes the feeling that between any two instants there are others? We arrange our recollections in time, but we know that there remain empty compartments. How could that be, if time were not a form preexistent in our mind? How could we know there were empty compartments, if these compartments were revealed to us only by their content?

II.

But that is not all; into this form we wish to put not only the phenomena of our own consciousness, but those of which other consciousnesses are the theater. But more, we wish to put there physical facts, these *I know not what* with which we people space and which no

consciousness sees directly. This is necessary because without it science could not exist. In a word, psychologic time is given to us and must needs create scientific and physical time. There the difficulty begins, or rather the difficulties, for there are two.

Think of two consciousnesses, which are like two worlds impenetrable one to the other. By what do we strive to put them into the same mold, to measure them by the same standard? Is it not as if one strove to measure length with a gram or weight with a meter? And besides, why do we speak of measuring? We know perhaps that some fact is anterior to some other, but not *by how much* it is anterior.

Therefore two difficulties: (1) Can we transform psychologic time, which is qualitative, into a quantitative time? (2) Can we reduce to one and the same measure facts which transpire in different worlds?

III.

The first difficulty has long been noticed; it has been the subject of long discussions and one may say the question is settled. *We have not a direct intuition of the equality of two intervals of time.* The persons who believe they possess this intuition are dupes of an illusion. When I say, from noon to one the same time passes as from two to three, what meaning has this affirmation?

The least reflection shows that by itself it has none at all. It will only have that which I choose to give it, by a definition which will certainly possess a certain degree of arbitrariness. Psychologists could have done without this definition; physicists and astronomers could not; let us see how they have managed.

To measure time they use the pendulum and they suppose by definition that all the beats of this pendulum are of equal duration. But this is only a first approximation; the temperature, the resistance of the air, the barometric pressure, make the pace of the pendulum vary. If we could escape these sources of error, we should obtain a much closer approximation, but it would still be only an approximation. New causes, hitherto neglected, electric, magnetic or others, would introduce minute perturbations.

In fact, the best chronometers must be corrected from time to time, and the corrections are made by the aid of astronomic observations; arrangements are made so that the sidereal clock marks the same hour when the same star passes the meridian. In other words, it is the sidereal day, that is, the duration of the rotation of the earth, which is the constant unit of time. It is supposed, by a new definition substituted for that based on the beats of the pendulum, that two complete rotations of the earth about its axis have the same duration.

However, the astronomers are still not content with this definition. Many of them think that the tides act as a check on our globe, and

that the rotation of the earth is becoming slower and slower. Thus would be explained the apparent acceleration of the motion of the moon, which would seem to be going more rapidly than theory permits because our watch, which is the earth, is going slow.

IV.

All this is unimportant, one will say; doubtless our instruments of measurement are imperfect, but it suffices that we can conceive a perfect instrument. This ideal can not be reached, but it is enough to have conceived it and so to have put rigor into the definition of the unit of time.

The trouble is that there is no rigor in the definition. When we use the pendulum to measure time, what postulate do we implicitly admit? *It is that the duration of two identical phenomena is the same;* or, if you prefer, that the same causes take the same time to produce the same effects.

And at first blush, this is a good definition of the equality of two durations. But take care. Is it impossible that experiment may some day contradict our postulate?

Let me explain myself. I suppose that at a certain place in the world the phenomenon α happens, causing as consequence at the end of a certain time the effect α'. At another place in the world very far away from the first, happens the phenomenon β, which causes as consequence the effect β'. The phenomena α and β are simultaneous, as are also the effects α' and β'.

Later, the phenomenon α is reproduced under approximately the same conditions as before, and *simultaneously* the phenomenon β is also reproduced at a very distant place in the world and almost under the same circumstances. The effects α' and β' also take place. Let us suppose that the effect α' happens perceptibly before the effect β'.

If experience made us witness such a sight, our postulate would be contradicted. For experience would tell us that the first duration $\alpha\alpha'$ is equal to the first duration $\beta\beta'$ and that the second duration $\alpha\alpha'$ is less than the second duration $\beta\beta'$. On the other hand, our postulate would require that the two durations $\alpha\alpha'$ should be equal to each other, as likewise the two durations $\beta\beta'$. The equality and the inequality deduced from experience would be incompatible with the two equalities deduced from the postulate.

Now can we affirm that the hypotheses I have just made are absurd? They are in no wise contrary to the principle of contradiction. Doubtless they could not happen without the principle of sufficient reason seeming violated. But to justify a definition so fundamental I should prefer some other guarantee.

V.

But that is not all. In physical reality one cause does not produce a given effect, but a multitude of distinct causes contribute to produce it, without our having any means of discriminating the part of each of them.

Physicists seek to make this distinction; but they make it only approximately, and, however they progress, they never will make it except approximately. It is approximately true that the motion of the pendulum is due solely to the earth's attraction; but in all rigor every attraction, even of Sirius, acts on the pendulum.

Under these conditions, it is clear that the causes which have produced a certain effect will never be reproduced except approximately. Then we should modify our postulate and our definition. Instead of saying: 'The same causes take the same time to produce the same effects,' we should say: 'Causes almost identical take almost the same time to produce almost the same effects.'

Our definition therefore is no longer anything but approximate. Besides, as M. Calinon very justly remarks in a recent memoir:[2]

> One of the circumstances of any phenomenon is the velocity of the earth's rotation; if this velocity of rotation varies, it constitutes in the reproduction of this phenomenon a circumstance which no longer remains the same. But to suppose this velocity of rotation constant is to suppose that we know how to measure time.

Our definition is therefore not yet satisfactory; it is certainly not that which the astronomers of whom I spoke above implicitly adopt, when they affirm that the terrestrial rotation is slowing down.

What meaning according to them has this affirmation? We can only understand it by analyzing the proofs they give of their proposition. They say first that the friction of the tides producing heat must destroy *vis viva*. They invoke therefore the principle of *vis viva*, or of the conservation of energy.

They say next that the secular acceleration of the moon, calculated according to Newton's law, would be less than that deduced from observations unless the correction relative to the slowing down of the terrestrial rotation were made. They invoke therefore Newton's law. In other words, they define duration in the following way: time should be so defined that Newton's law and that of *vis viva* may be verified. Newton's law is an experimental truth; as such it is only approximate, which shows that we still have only a definition by approximation.

If now it be supposed that another way of measuring time is adopted, the experiments on which Newton's law is founded would none the less have the same meaning. Only the enunciation of the law would be different, because it would be translated into another

[2] 'Etude sur les diverses grandeurs,' Paris, Gauthier-Villars, 1897.

language; it would evidently be much less simple. So that the definition implicitly adopted by the astronomers may be summed up thus: Time should be so defined that the equations of mechanics may be as simple as possible. In other words, there is not one way of measuring time more true than another; that which is generally adopted is only more *convenient*. Of two watches, we have no right to say that the one goes true, the other wrong; we can only say that it is advantageous to conform to the indications of the first.

The difficulty which has just occupied us has been, as I have said, often pointed out; among the most recent works in which it is considered, I may mention, besides M. Calinon's little book, the treatise on mechanics of M. Andrade.

VI.

The second difficulty has up to the present attracted much less attention; yet it is altogether analogous to the preceding; and even, logically, I should have spoken of it first.

Two psychological phenomena happen in two different consciousnesses; when I say they are simultaneous, what do I mean? When I say that a physical phenomenon, which happens outside of every consciousness, is before or after a psychological phenomenon, what do I mean?

In 1572, Tycho Brahe noticed in the heavens a new star. An immense conflagration had happened in some far distant heavenly body; but it had happened long before; at least two hundred years were necessary for the light from that star to reach our earth. This conflagration therefore happened before the discovery of America. Well, when considering this gigantic phenomenon, which perhaps had no witness, since the satellites of that star were perhaps uninhabited, I say this phenomenon is anterior to the formation of the visual image of the isle of Española in the consciousness of Christopher Columbus, what do I mean?

A little reflection is sufficient to understand that all these affirmations have by themselves no meaning. They can have one only as the outcome of a convention.

VII.

We should first ask ourselves how one could have had the idea of putting into the same frame so many worlds impenetrable to each other. We should like to represent to ourselves the external universe, and only by so doing could we feel that we understood it. We know we never can attain this representation: our weakness is too great. But at least we desire the ability to conceive an infinite intelligence for which this representation would be possible, a sort of great con-

sciousness which should see all, and which should classify all *in its time*, as we classify, *in our time*, the little we see.

This hypothesis is indeed crude and incomplete, because this supreme intelligence would be only a demigod; infinite in one sense, it would be limited in another, since it would have only an imperfect recollection of the past; and it could have no other, since otherwise all recollections would be equally present to it and for it there would be no time. And yet when we speak of time, for all which happens outside of us, do we not unconsciously adopt this hypothesis; do we not put ourselves in the place of this imperfect god; and do not even the atheists put themselves in the place where god would be if he existed?

What I have just said shows us, perhaps, why we have tried to put all physical phenomena into the same frame. But that can not pass for a definition of simultaneity, since this hypothetical intelligence, even if it existed, would be for us impenetrable. It is therefore necessary to seek something else.

VIII.

The ordinary definitions which are proper for psychologic time would suffice us no better. Two simultaneous psychologic facts are so closely bound together that analysis can not separate without mutilating them. Is it the same with two physical facts? Is not my present nearer my past of yesterday than the present of Sirius?

It has also been said that two facts should be regarded as simultaneous when the order of their succession may be inverted at will. It is evident that this definition would not suit two physical facts which happen far from one another, and that, in what concerns them, we no longer even understand what this reversibility would be; besides, succession itself must first be defined.

IX.

Let us then seek to give an account of what is understood by simultaneity or antecedence, and for this let us analyze some examples.

I write a letter; it is afterward read by the friend to whom I have addressed it. There are two facts which have had for their theater two different consciousnesses. In writing this letter I have had the visual image of it, and my friend has had in his turn this same visual image in reading the letter. Though these two facts happen in impenetrable worlds, I do not hesitate to regard the first as anterior to the second, because I believe it is its cause.

I hear thunder, and I conclude there has been an electric discharge; I do not hesitate to consider the physical phenomenon as anterior to the auditory image perceived in my consciousness, because I believe it is its cause.

Behold then the rule we follow, and the only one we can follow:

when a phenomenon appears to us as the cause of another, we regard it as anterior. It is therefore by cause that we define time; but most often, when two facts appear to us bound by a constant relation, how do we recognize which is the cause and which the effect? We assume that the anterior fact, the antecedent, is the cause of the other, of the consequent. It is then by time that we define cause. How save ourselves from this *petitio principii?*

We say now *post hoc, ergo propter hoc;* now *propter hoc, ergo post hoc;* shall we escape from this vicious circle?

X.

Let us see, not how we succeed in escaping, for we do not completely succeed, but how we try to escape.

I execute a voluntary act *A* and I feel afterward a sensation *D,* which I regard as a consequence of the act *A;* on the other hand, for whatever reason, I infer that this consequence is not immediate, but that outside my consciousness two facts *B* and *C,* which I have not witnessed, have happened, and in such a way that *B* is the effect of *A,* that *C* is the effect of *B,* and *D* of *C.*

But why? If I think I have reason to regard the four facts *A, B, C, D,* as bound to one another by a causal connection, why range them in the causal order *A B C D,* and at the same time in the chronologic order *A B C D,* rather than in any other order?

I clearly see that in the act *A* I have the feeling of having been active, while in undergoing the sensation *D,* I have that of having been passive. This is why I regard *A* as the initial cause and *D* as the ultimate effect; this is why I put *A* at the beginning of the chain and *D* at the end; but why put *B* before *C* rather than *C* before *B*?

If this question is put, the reply ordinarily is: we know that it is *B* which is the cause of *C* because we *always* see *B* happen before *C.* These two phenomena, when witnessed, happen in a certain order; when analogous phenomena happen without witness, there is no reason to invert this order.

Doubtless, but take care; we never know directly the physical phenomena *B* and *C.* What we know are sensations *B′* and *C′* produced respectively by *B* and *C.* Our consciousness tells us immediately that *B′* precedes *C′* and we *suppose* that *B* and *C* succeed one another in the same order.

This rule appears in fact very natural, and yet we are often led to depart from it. We hear the sound of the thunder only some seconds after the electric discharge of the cloud. Of two flashes of lightning, the one distant, the other near, can not the first be anterior to the second, even though the sound of the second comes to us before that of the first?

XI.

Another difficulty; have we really the right to speak of the cause of a phenomenon? If all the parts of the universe are interchained in a certain measure, any one phenomenon will not be the effect of a single cause, but the resultant of causes infinitely numerous; it is, one often says, the consequence of the state of the universe a moment before. How enunciate rules applicable to circumstances so complex? And yet it is only thus that these rules can be general and rigorous.

Not to lose ourselves in this infinite complexity let us make a simpler hypothesis. Consider three stars, for example, the sun, Jupiter and Saturn; but, for greater simplicity, regard them as reduced to material points and isolated from the rest of the world. The positions and the velocities of three bodies at a given instant suffice to determine their positions and velocities at the following instant, and consequently at any instant. Their positions at the instant t determine their positions at the instant $t + h$ as well as their positions at the instant $t - h$.

Even more; the position of Jupiter at the instant t, together with that of Saturn at the instant $t + a$, determines the position of Jupiter at any instant and that of Saturn at any instant.

The aggregate of positions occupied by Jupiter at the instant $t + e$ and Saturn at the instant $t + a + e$ is bound to the aggregate of positions occupied by Jupiter at the instant t and Saturn at the instant $t + a$, by laws as precise as that of Newton, though more complicated. Then why not regard one of these aggregates as the cause of the other, which would lead to considering as simultaneous the instant t of Jupiter and the instant $t + a$ of Saturn?

In answer there can only be reasons, very strong, it is true, of convenience and simplicity.

XII.

But let us pass to examples less artificial; to understand the definition implicitly supposed by the savants, let us watch them at work and look for the rules by which they investigate simultaneity.

I will take two simple examples, the measurement of the velocity of light and the determination of longitude.

When an astronomer tells me that some stellar phenomenon, which his telescope reveals to him at this moment, happened nevertheless fifty years ago, I seek his meaning, and to that end I shall ask him first how he knows it, that is, how he has measured the velocity of light.

He has begun by *supposing* that light has a constant velocity, and in particular that its velocity is the same in all directions. That is a postulate without which no measurement of this velocity could be attempted. This postulate could never be verified directly by experi-

ment; it might be contradicted by it if the results of different measurements were not concordant. We should think ourselves fortunate that this contradiction has not happened and that the slight discordances which may happen can be readily explained.

The postulate, at all events, resembling the principle of sufficient reason, has been accepted by everybody; what I wish to emphasize is that it furnishes us with a new rule for the investigation of simultaneity, entirely different from that which we have enunciated above.

This postulate assumed, let us see how the velocity of light has been measured. You know that Roemer used eclipses of the satellites of Jupiter, and sought how much the event fell behind its prediction. But how is this prediction made? It is by the aid of astronomic laws, for instance Newton's law.

Could not the observed facts be just as well explained if we attributed to the velocity of light a little different value from that adopted, and supposed Newton's law only approximate? Only this would lead to replacing Newton's law by another more complicated. So for the velocity of light a value is adopted, such that the astronomic laws compatible with this value may be as simple as possible. When navigators or geographers determine a longitude, they have to solve just the problem we are discussing; they must, without being at Paris, calculate Paris time. How do they accomplish it? They carry a chronometer set for Paris. The qualitative problem of simultaneity is made to depend upon the quantitative problem of the measurement of time. I need not take up the difficulties relative to this latter problem, since above I have emphasized them at length.

Or else they observe an astronomic phenomenon, such as an eclipse of the moon, and they suppose that this phenomenon is perceived simultaneously from all points of the earth. That is not altogether true, since the propagation of light is not instantaneous; if absolute exactitude were desired, there would be a correction to make according to a complicated rule.

Or else finally they use the telegraph. It is clear first that the reception of the signal at Berlin, for instance, is after the sending of this same signal from Paris. This is the rule of cause and effect analyzed above. But how much after? In general, the duration of the transmission is neglected and the two events are regarded as simultaneous. But, to be rigorous, a little correction would still have to be made by a complicated calculation; in practise it is not made, because it would be well within the errors of observation; its theoretic necessity is none the less from our point of view, which is that of a rigorous definition. From this discussion, I wish to emphasize two things: (1) The rules applied are exceedingly various. (2) It is difficult to separate the qualitative problem of simultaneity from the quantitative problem of

the measurement of time; no matter whether a chronometer is used, or whether account must be taken of a velocity of transmission, as that of light, because such a velocity could not be measured without *measuring* a time.

XIII

To conclude: We have not a direct intuition of simultaneity, nor of the equality of two durations. If we think we have this intuition, this is an illusion. We replace it by the aid of certain rules which we apply almost always without taking count of them.

But what is the nature of these rules? No general rule, no rigorous rule; a multitude of little rules applicable to each particular case.

These rules are not imposed upon us and we might amuse ourselves in inventing others; but they could not be cast aside without greatly complicating the enunciation of the laws of physics, mechanics and astronomy.

We therefore choose these rules, not because they are true, but because they are the most convenient, and we may recapitulate them as follows: "The simultaneity of two events, or the order of their succession, the equality of two durations, are to be so defined that the enunciation of the natural laws may be as simple as possible. In other words, all these rules, all these definitions are only the fruit of an unconscious opportunism."

(*To be continued.*)

FRANCIS BACON AND THE MODERN UNIVERSITY

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THE student of the history of education marvels at the tenacity with which the aims and methods of scholasticism and the middle ages maintained their hold upon the universities. The use of Latin as exclusive means of communication and the worship of Aristotle as source of final authority upon all questions marked the universities as medieval long after the world at large had moulted its chrysalis and become modern. At the opening of the nineteenth century only traces of advancement were perceptible; fortunately that century has seen changes nothing short of revolutionary in the ideals and methods of the institutions of higher learning.

It is a commonplace that Francis Bacon was the herald, if not the originator, of that scientific method which more than anything else has wrought the reform of the university; but the work went on for two centuries outside the sacred limits of the universities, and, as we have seen, gained access to them only in the third century after Bacon's time. And yet we hope to show that he foresaw and described accurately the essential changes needed to fit these institutions for their true work.

One naturally thinks first in this connection of the New Atlantis, and the 'Salomon's House' described therein, which was 'the lantern of the kingdom—and dedicated to the study of the works and creatures of God'; and no one can fail to perceive in this fantasy of Bacon's imagination striking hints of modern scientific investigation and of that organization and cooperation which are so essential a means of progress in knowledge. But for our present purpose better material is found in a serious discussion of the needs of higher education and scientific research in the first chapter of Book II. of the 'Advancement of Learning.' Bacon proposes here to set forth the 'direction, or the pointing out and delineation of the direct way to the completion of the object in view,' that is, of the advancement of knowledge. The lines of progress he advocates are six in number; let us examine them briefly in order.

First, "among so many illustrious colleges in Europe, all the foundations are engrossed by the professions, none being left for the free cultivation of the arts and sciences. . . . There is no collegiate course so free as to allow those who are inclined to devote themselves

to history, modern languages, civil policy and general literature; . . ." With this compare President Eliot's 'What is a Liberal Education,' written in 1884; President Eliot names as subjects entitled to full admission into higher culture these five: English literature, French and German, history, political economy and natural science. The first four are practically identical with Bacon's list; and the last, natural science, is abundantly championed by Bacon in discussing what he names as the third and sixth defects of the existing system. What Bacon, as intellectual seer, prescribed, Eliot, as foremost actor in university reform in America at least, confirms and urges. Moreover, the fulfilment of Bacon's word is the more wonderful in that for two centuries after he wrote, almost no movement occurred in the dry bones of the traditional system, and that within the limits the third hundred years the five subjects in question have conquered their rightful place in higher education.

The second defect which Bacon saw in the institutions of his own day is one which will appeal at once to those who even in this better age earn their bread by service in the armies of science and learning—'the mean salaries apportioned to public lectureships, whether in the sciences or the arts.' Even in this matter all must admit that progress has been made since Bacon's time; and all will agree that Bacon was right in pointing to higher compensation of the scientific laborer as one of the indispensable conditions of large and general progress in the work. It is safe to say that the economic condition of the individual worker in these fields is far better to-day than it was in the sixteenth century; and the total sum applied to the advancement of learning, and especially to those very branches that Bacon so much advocated, is immeasurably vaster than ever before in the history of the world, and yearly increasing.

"The next deficiency we shall notice," says Bacon, "is the want of philosophical instruments. . . . To study natural philosophy, physic and many other sciences to advantage, books are not the only essentials—other instruments are required." Bacon goes on to mention what has already been done in this direction—the use of spheres, globes, astrolabes, maps; and the provision of 'gardens for the growth of simples' and dead bodies for dissection, for schools of medicine. But what has been done is entirely inadequate; 'there will be no inroad made into the secrets of nature unless experiments, be they of Vulcan or Daedalus (air ships?), furnace, engine or any other kind, are allowed for; . . . you must allow the spies and intelligencers of nature to bring in their bills, or else you will be ignorant of many things worthy to be known.' With what joy would the writer of this have beheld the laboratories of a modern university; how he would

have glowed with enthusiasm over experiment stations and a Carnegie Institution!

The fourth point is more distinctly educational: 'neglect of proper supervision or diligent inquiry into the course of studies, with a view to a thorough reformation of such parts as are ill-suited to the age, or of unwise institution.' Bacon gives two specimens of faults in the existing course of study: first, that scholars are inducted too early into logic and rhetoric; and second, that invention and memory are not exercised together. These are evidently mentioned rather to indicate the kind of reforms which Bacon here intends, than for any peculiar importance attaching to them. Perhaps nothing is more characteristic of modern education than just this 'diligent inquiry into the course of study' which Bacon recommends; not indeed that we may yet count ourselves to have attained to perfection in the matter of actual reformation, nor to have yet cast off all that was fit only for the 'obscure times' in which our curricula were first formed. But throughout the civilized world those responsible for the training of the young—teachers, parents and statesmen—are giving themselves with resolute purpose to the discovery and ordering of the best means of education, for all ages from infancy to maturity.

The next defect is 'the little sympathy and correspondence which exists between colleges and universities, as well throughout Europe as in the same state and kingdom.' Evidently the possession of a common academic language did not insure complete academic harmony and cooperation! One can not doubt that Bacon would have seen many fulfilments of this desire of his in modern university life: learned societies, associations of colleges and schools, conferences, philosophical and scientific journals, scientific congresses at international expositions, and the like. Perhaps the ceremonies of inducting a president of a university into his office would have seemed to him particularly to show forth 'a fraternity of learning and illumination, relating to that paternity which is attributed to God, who is called the Father of lights.'

"Lastly," says Bacon, "I may lament that no fit men have been engaged to forward those sciences which yet remain in an unfinished state." Lastly, indeed, but not least; rather may we believe that this forwarding of the unfinished sciences lay nearest of all to the heart of the author of the Instauration Magna, a work undertaken, he tells us, to 'perform, as it were, a lustrum of the sciences, and to take account of what have been prosecuted and what omitted.' None of Bacon's admonitions have been more fully heeded by the universities most worthy of the name; indeed it has come to be a mark of a genuine university that its teachers should be all 'fit men to forward the unfinished sciences'—in other words, investigators. How vast has been the actual progress in the lustrum of the sciences may perhaps best

be felt by comparing the strange and antiquated terms in the outline of Books III. and IV. of the Advancement, where Bacon catalogues the sciences, with the list of departments of study in some great university of to-day. The sciences of which Bacon knew have been advanced to a place far beyond the highest imaginings of even his great mind in that time; and new regions of knowledge have been opened of which he could not dream. Even more significant is the fact that we have given up believing in even the possibility of a *finished* science; all are unfinished, and therefore it is the duty of every devotee to labor for advance. The universities, after centuries of inertia, have at last waked, or rather been somewhat vigorously aroused, to their duty to be creators as well as conservators of the store of knowledge.

Thus when the sixteenth century had barely closed, Bacon pointed out these six ways in which higher education and research needed to advance: a more liberal curriculum, more generous financial support, better and more abundant apparatus for experiment and investigation, a rational organization of the course of study, sympathy and cooperation between all colleges and universities, and the prosecution of the 'unfinished sciences.' History has wonderfully justified his verdict, and we may well pronounce him the prophet of the modern university.

BRITICISMS VERSUS AMERICANISMS

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IT is a recognized fact that there is a considerable variation in the English language as spoken by the two great branches of the Anglo-Saxon race. The English people differ from the American people in the use of our common speech not only in their characteristic mode of pronunciation and orthography, but they also differ from us in no less striking a manner in the use of certain idioms and household phrases, which constitute the small change of our every-day speech. This difference is the natural outgrowth of the separation of the two peoples by the estranging ocean, which is of necessity a great barrier to complete intercourse. To be sure, the fact that the English people and the American people have distinct national entities with the resulting difference, during the last hundred years, of national ideals and pursuits, has had the natural and inevitable effect of widening the breach between the speech of the two countries. No doubt the present variation will be accentuated more and more as the years go by, and the language of Great Britain and of America, far from becoming absolutely identical in pronunciation and idiom with the flight of centuries, will go on developing with an ever-increasing divergence from the common standard. If this be true—and certainly the facts as to the present tendency seem to warrant such a conclusion—the final result may be the unique linguistic phenomenon of two separate and distinct English tongues, if such a thing be not an impossibility.

Before pointing out the variations of our American English from British English, it may be interesting to note the source of our American vernacular, and the contributing causes of the chief variations from the authoritative standard of the mother country.

When our Saxon forefathers found their way to the shores of this western continent and here established their permanent abode, the settlers naturally brought with them the language of their native country. This was, of course, the noble tongue of Shakespeare and Milton. Our British cousins who criticize our English so freely and cast reproach upon it as if it were a mere jargon, a barbarous *patois*, evidently lose sight of the fact that it boasts the same high pedigree as their own much-vaunted Elizabethan speech. When the English language was first transplanted in American soil, it was identical in orthography, orthoepy and idiom with the speech of the mother

country. But the transplanted tongue, having a new and different habitat, began at once to adapt itself, however imperceptibly, to its changed environ and new conditions. Nor was the connection with the parent stock a sufficiently close and vital bond of union to prevent the English speech on American lips from undergoing at least some slight modification in the course of time, as a natural consequence of the altered conditions in the new world.

It is a well-established linguistic principle that a language inevitably undergoes a slight change, determined by the varying conditions, as long as it is spoken. When a tongue ceases to be spoken, then and only then does it cease to change and become a dead language, as, for instance, Latin and Greek. This fact of the gradual change in a living language is demonstrated through the difficulty one experiences in understanding the English of Chaucer, or even of Shakespeare, for the matter of that, although he is not so far removed from the present age. If a living tongue underwent no alteration with the lapse of years, then why should not Anglo-Saxon be as readily intelligible to us as modern English?

Furthermore, a language is affected in its development by contact with a foreign tongue and by outside influences, such as the climate. The first of these reasons is so apparent to all that it hardly deserves comment. But not so the second. Yet the influence of climate on a living language is very fruitful of change. Ready proof of this is furnished in our own country in the soft, musical utterance of the south in contrast with the rather shrill and forceful habits of enunciation characteristic of the north. In Europe, for example, the vast preponderance of the harsh, guttural character of the German tongue offers a glaring contrast to the smooth, liquid notes of the pure Tuscan speech. This is the reason why Italian appeals so strongly to music lovers and to all who have an ear trained to be especially sensitive to sound. Now, this difference between German and Italian, as respects the musical character of the two languages, is doubtless to be explained in large measure as the result of climate conditions extending through many long centuries. If by some violent political upheaval the Italians were transported to the extreme northern part of Europe, it is altogether probable that their speech in the course of centuries would lose much of its native vocalic development, much of its melody, and become harsh and strident, somewhat like the Russian language. It follows, therefore, that the English speech on American soil has undergone some slight modification, in consequence of climatic influence. Perhaps this explains the variation of the American pronunciation of the long *o*-sound as in 'stone' and 'bone' from the British norm. But the difference in climate between the two countries is not sufficiently marked to produce any very radical departure.

A striking feature of the English speech on American lips is the leveling of the long *a*-sound heard in such words as 'past,' 'fast,' 'plant,' 'command,' 'dance,' 'path,' etc. This could hardly be the result of climatic influence, however, for it does not appear that the climate has had the effect of producing any modification in the pronunciation of such terms in any part of America. The prevailing pronunciation of these terms is the same, at the south and at the north alike. Such a variation must, therefore, be inherent in the natural growth of the English language on American soil. For it must be borne in mind that just as the English speech, as any other living organism, has been growing and developing during the centuries in England, so, likewise, in America it has been growing and developing during the last three centuries, but not necessarily in the same manner. Those employing the language in Great Britain and in the United States are no longer a homogeneous people with the same national ideals and destiny. On the contrary, they are two separate and distinct nations with different forms of government and with different aims and aspirations. Add to this the fact that the nations have been estranged by political differences which resulted in wars and that they are separated by the physical barrier of a vast ocean. In the face of these obstacles it is not at all surprising that the English speech has not gone on developing *pari passu* on both sides of the Atlantic. The wonder is that the present variations are not really greater and more striking than they are.

Another contributing cause of variation of American English from the British norm must not be overlooked, the more especially as it has proved a prolific factor. In our new country some conditions of life arose which were totally unlike those existing in the old country. Such strange conditions called imperatively for the invention of new names and thus gave rise to the employment of new phrases and new locutions. These had to be coined immediately for the emergency. Since the most distinctive traits of the American are initiative and wealth of resource, no time was lost in making such additions to the English speech as seemed to supply a felt need, and that, too, without any special reference to British models and precedents. Hence a large class of terms distinctively American and bearing upon their face the trade-mark 'made in America' found their way into the English vocabulary on this side of the Atlantic, much to the disgust of the British precisians and purists, who proceeded forthwith to put these new coinages under the ban and to brand them with the bend sinister of 'Americanism.' Of this class are many terms indicating mechanical inventions and appliances, such as 'elevator' instead of the British 'lift,' to mention only a single example of a long catalogue of useful things which American genius has given to the world. Here also be-

long numerous words expressing things associated with modern transportation and rapid transit, such as 'street-car,' 'railroad,' etc.

Perhaps it may be well just here to call attention to some of the ordinary terms and expressions heard in England which strike an American as being quite odd and peculiar. It is to be presumed that the good Britons will not be offended if we, using the same license as themselves, venture to call such expressions 'Briticisms.' Let it be distinctly understood, however, that this is not intended as an opprobrious epithet, but only to signify a word or an idiom which is peculiar to Great Britain and not familiar in America. For surely the English people have the right to employ whatever terms they may choose both in their colloquial and in their written speech.

If an American in London wishes to use a language that is readily understood, when he goes to the ticket office he must call it the booking office of the railway station. There he must ask the clerk, or rather the 'clark,' for a first single or a second return, instead of a single fare (first class) and a round trip (second class). He must then have his luggage labeled, not his baggage checked, and, having secured his brasses or labels, not his checks, he sees his box, not his trunk, put in the proper van and then takes his seat in the carriage, not in the car. Before the train starts off, the guards slam the doors of the carriages, turning the handles, and at the conductor's whistle the engine-driver starts his locomotive-engine. The points all being set for a clear track ahead, the train speeds along the metals, passing perhaps a shunting-engine about the station and a train of goods-vans.

The variation of British from American usage is not more noteworthy in railway parlance than in other circles. If an American goes shopping in London, he must call for a packet, not a paper, of pins; a reel, not a spool, of cotton. If he desires to buy a pair of shoes, he must call for boots, unless he wishes low quarters or Oxford ties; if a pair of overshoes, he must ask for footholds or galoshes; if a soft felt hat, he must ask for a squash hat, or if he prefers a Derby, he must ask for a billy-cock hat or a bowler; if he wishes a pad of paper, he should request a block of paper. If he goes to a restaurant, he indicates whether he desires his meat underdone, not rare; if he wishes corned beef, he calls for silversides of beef; if beets, he calls for beetroot; if chicken, he calls for fowl; if a cereal of any sort, he calls for corn; if cold bread, he must order cut bread; and if he desires pudding, pie, jam, preserves or candy, he must order sweets, short for sweetmeats. If the waiter should fail for any reason to give him a napkin, an American should ask for a serviette; and when he has finished his repast, he is handed a bill which he may pay with his cheque, or, if he prefers, with the cash from his purse, not his pocket-book.

If in England you find no bowl and pitcher in your room, you are

expected to call for a jug and basin, since there a pitcher means only a little jug and a bowl is used exclusively for serving food in. On the street, instead of a letter box near a lamp post, you see a pillar box near a lamp pillar, and you perhaps meet a person pushing a perambulator, called 'pram' for short, instead of a baby-carriage. For dry-goods you go to a mercer's, where you will find white calico sold for muslin. For cloth you go to a draper's, for wooden ware to a turnery, for hardware to an ironmonger's, for milk, butter and eggs to a cow-keeper's or a dairy, and for fish, game and poultry to a fish shop. If you desire any of your purchases sent to your address, you order them sent by express-carrier, carriage paid.

If at any time you desire the services of a scrub-woman to clean your apartments, you send for a charwoman. If you wish to have some furniture upholstered, you request the upholder to undertake the work for you. If you need the services of a doctor, you call in a medical man. You must be careful to address surgeons and dentists by the common democratic title 'mister,' since the English custom does not warrant you to address them as 'doctor.' If you are well, to your inquiring friends you are reported 'fit,' if unwell, 'seedy,' if sick, invariably 'ill.'

To an American ear British orthoepy offers quite as noteworthy surprises as the idiomatic diction does. Of course it is to be presumed that there should be more or less marked variations in the matter of habitual utterance of certain sounds, especially the long *o*- and the long *a*-vowel, as in 'fast,' 'dance,' 'sha'n't,' etc., which are at striking variance with American usage. Indeed, these sounds are so characteristic that, like the English custom of ending almost every sentence with a question, when clearly natural and not an affectation, they serve as a shibboleth of British nativity. But notable eccentricities are to be observed in the English mode of pronouncing many proper names such as Derby, pronounced 'darby'; Berkeley, pronounced 'barclay'; Magdalen, pronounced 'maudlin'; Cadogan, pronounced 'kerduggan'; Marylebone, pronounced 'merrybone'; Cholmondeley, pronounced 'chumly'; Marlborough, pronounced 'mobrer'; Albany, pronounced so that the first syllable rhymes with Al- in Alfred, etc. It is unnecessary to multiply examples. Suffice it to say that there is a large class of these words the spelling and pronunciation of which seem to an American rather curiously divorced. Certainly American usage offers no parallel where there is so complete a divorce of orthoepy from orthography. American usage makes for phonetic spelling and tends to make the conventional pronunciation and spelling conform somewhat, at least.

Having drawn attention to a few Briticisms, we are now prepared to discuss some of our Americanisms which seem to excite in the pure

minds of the English precisians alternate feelings of disgust and indignation. Let it be premised, however, that it is not proposed to include ordinary slang in the present discussion. It must be admitted that too much slang is employed even in polite circles, not to mention the speech of those who make no pretense to refinement and culture. But one should not confuse vulgarisms with so-called Americanisms, just as one should not confuse vulgarisms with legitimate slang. The discriminating student distinguishes between ordinary slang and legitimate slang. The vulgar slang of the street is, of course, to be universally condemned and tabooed. Legitimate slang, on the contrary, performs an important function in the development of a living language. It is not to be inconsiderately ostracized, therefore, and put under the ban as the chief source of corruption of our vernacular, as certain of our purists, in their zeal without knowledge, tell us and attempt to maintain. It is idle for them in their self-appointed rôle of guardian of the pristine purity of the English tongue to endeavor to defend so unsound and so indefensible a thesis. For legitimate slang, far from being an unmitigated evil and a constant menace to the purity and propriety of our noble tongue, is standard English in the making, is idiom in the nascent state before it has attained to the dignity of correctness of usage. To change the figure, legitimate slang is the recruiting ground whence come the new and untried words which are to take the place in the vernacular, of the archaic and obsolete words, dropping out of the ranks. But it is aside from the main purpose of this paper to discuss the relation of slang to standard usage (cf. 'What is slang?' POPULAR SCIENCE MONTHLY, February, 1906), and hence this only in passing.

By an Americanism, as here used, is meant a word, phrase or idiom of the English tongue, in good standing, which has originated in America or is in use only on this side of the Atlantic. It will be seen, therefore, that all mere slang expressions, even though they be of American origin, are barred from the present consideration. In his dictionary of 'Americanisms,' Bartlett gives a large collection, many of which the above limitation, of course, excludes.

Of reputed Americanisms, as one might surmise, there are several classes to be distinguished, without any very clearly defined line of demarcation separating them. One class includes a large number of phrases which had their origin in England and were transported thence to our shores by the first settlers who came from the mother country and established themselves in Virginia and Massachusetts. In the last analysis these locutions appear to be transplanted British provincialisms, not a few of which came over in the *Mayflower*. Some of our British critics who are not as familiar with the history of the English language as they might be do not hesitate to deliver an offhand opin-

ion, pronouncing an apparent neologism an Americanism, when as a matter of fact the expression shows a good English pedigree extending back many generations. A more intimate acquaintance with the history of our common speech would save them the embarrassment from such a glaring blunder. But it is so easy to fall into the careless habit of branding as an Americanism an unfamiliar idiom or a phrase that is rarely heard in England. This convenient term has thus become in England a reproach, inasmuch as a certain stigma, somehow, attaches to it in the British mind. But for all that, like charity, it covers a multitude of sins, sins of keen prejudice, no less than of crass ignorance.

Many of the so-called Americanisms are really survivals of Elizabethan English and boast a Shakespearean pedigree, although they are no longer heard in the country of that consummate master of our speech. Somehow, they seem to have drifted out of the main current of British English. Perhaps they have been caught up by an eddy and carried into one of the provinces where they are still preserved, as they are in America, fresh and vigorous. A moment's reflection will show that we Americans come rightly by our Elizabethan English. For surely New England, Maryland and Virginia were settled by those who spoke the tongue of Shakespeare, even though they did not all hold the faith and morals of Milton. Many of these settlers—both Puritan and Cavalier—were college-bred men, graduates of Oxford and Cambridge. Therefore they inherited the best traditions of the English speech and transmitted it uncorrupted to their children. Nor were their children wilful traducers and corruptors of the King's English, but contrariwise they conserved it and safeguarded its purity quite as sedulously as the inhabitants of the mother country. Thus the English speech was handed down, undefiled, from one generation to another, in America. Hence some words and phrases of good Elizabethan usage have been preserved in America, which long ago became obsolete and dropped out of the living speech in England, where the growth of the language was, of course, not arrested by the rude shock incident to its being transplanted in a foreign country.

Let us now point out a few examples of reputed Americanisms, social pariahs which have lost caste and no longer move in polite circles in England. An interesting example is found in the word 'fall' used in the sense of autumn. Both these terms are in favor in America, although the pedants, following the lead of British critics, proscribe the use of 'fall.' We are told it is not employed in standard English, and hence must be censured as provincial. Yet 'fall,' which enjoys a certain poetic association with the fall of the leaf, can offer in its support the high authority of Dryden, who employed it in his translation of Juvenal's satires:

> What crowds of patients the town doctor kills,
> Or how last fall he raised the weekly bills.

In his 'Northern Farmer,' Tennyson used the offending word, but of course under the cloak of a provincialism. Still Freeman did not deign to employ it. Commenting on it, he remarks: "If fall as a season of the year has gone out of use in Britain, it has gone out very lately. At least I remember perfectly well the phrase of 'spring and fall' in my childhood."

Another good illustration of a word still surviving in American usage, but long ago discarded in England, is 'sick' in the sense of ill. British usage restricts the meaning to nausea, employing ill to describe a man suffering with a disease of whatever sort. Yet 'sick' is supported by the very best literary authority. The term occurs again and again in Elizabethan literature. Reference to Bartlett's concordance will convince even the most skeptical that the word abounds in Shakespeare, and that, too, in passages where the correct interpretation leaves no doubt that 'ill' is meant. Suffice it to cite only an example or two: In 'Midsummer Night's Dream' (act 1, scene 1), Shakespeare makes Helena say, 'Sickness is catching'; again in 'Cymbeline' (act 5, scene 4), we read, 'Yet am I better than one that's sick of the gout'; and in 'Romeo and Juliet' (act 5, scene 2), we read, 'Here in this city visiting the sick.' Not only so. 'Sick,' in the American acceptation, has an unbroken line of the best literary authority from Chaucer, 'that well of English undefiled,' down to Doctor Johnson, whose dictionary defines the word in reference to a person afflicted with disease. American usage, furthermore, is supported by the King James version, in which 'ill' is nowhere found, and also by the Anglican Church ritual. It is needless to multiply citations. If Americans sin in the improper use of 'sick,' it may be urged in extenuation that they can at least plead a long array of illustrious and unimpeachable authority and are in good company.

The use of 'well' as an interjection is mentioned by Bartlett in his dictionary as one of 'the most marked peculiarities of American speech.' Moreover, he adds, 'Englishmen have told me that they could always detect an American by the use of this word.' If this is an infallible hall-mark of American speech, then American English is nearer the tongue of Shakespeare than British English of the present day. For the word 'well' in the sense of an interjection occurs again and again in Shakespeare. In 'Hamlet' (act 1, scene 1), Bernardo asks, 'Have you had a quiet guard?' Francisco replies, 'Not a mouse stirring.' Whereupon Bernardo adds, 'Well, good-night.' Again, in 'Midsummer Night's Dream' (act 3, scene 1):

> *Bottom.* And then indeed let him name his name, and tell them plainly he is Snug the joiner.
>
> *Quince.* Well, it shall be so.

In Beaumont and Fletcher's 'Captain' (act 3, scene 3), we find an excellent example in the line, 'Well, I shall live to see your husbands beat you.' No one, of course, would think of charging Tennyson with using unidiomatic English. Yet, in 'Locksley Hall,' you read:

'Well—'t is well that I should bluster.'

Surely it is superfluous to cite further examples from English authors showing that American usage in the case of 'well' as an interjection is perfectly good English, even if the locution is censured by British pedantry and never heard on British lips.

The trite and hard-worked 'guess,' as characteristic of American speech as the much-abused 'fancy' is of British speech, furnishes another conspicuous example of a reputable word in Elizabethan English which has become obsolete in England, but is still preserved on this side of the Atlantic. There is no doubt that our constant employment of this good old Saxon word to do service on every occasion and to express every shade of thought from mild conjecture to positive assertion is somewhat inelegant; and this circumstance has perhaps contributed to bring the overtaxed phrase into disrepute with our kin across the sea. Yet there is abundant warrant in Elizabethan usage for the familiar notation we give 'guess' in our every-day speech, although it is generally confined to its strict meaning of conjecture in that period of the language. We find it used in the familiar sense of 'think' in several passages in Shakespeare, notably in 'I. Henry VI.' (act 2, scene 1):

Not altogether; better far, I guess,
That we do make our entrance several ways.

Likewise, in 'Measure for Measure' (act 4, scene 4):

Angelo. And why meet him at the gates and redeliver our authorities there?

Escalus. I guess not.

So, again, in the 'Winter's Tale' (act 4, scene 3):

Camillo. Which, I do guess, you do not purpose to him.

But this meaning of 'guess' is common throughout the entire history of English literature, for the word has always borne the sense of think, cheek by jowl with its specific meaning of conjecture. It is so employed by Chaucer and Gower in early times and in the last century by Sheridan and Wordsworth, certainly good literary authority enough. However, this meaning of the term appears to have died out in the present-day British speech, and the word is there employed strictly in the sense of conjecture, its lost sense being supplied by 'fancy.' Now, as between the Briton's 'fancy' and the American's 'guess,' there may not be much choice. But certainly the employment of 'guess' which our British cousins claim to be a shibboleth of American nationality

does not indicate any misuse of our mother tongue, as they contend.

Only one more case shall be adduced in illustration, to wit, our word 'baggage,' which the other half of the Anglo-Saxon race has discarded for 'luggage.' Here again, as elsewhere in the exercise of our prerogative, we have demonstrated our independence of the mother country in the matter of our speech and have chosen one term while the English people have adopted another, to designate the same thing. Both words have a good literary pedigree extending several centuries back. Shakespearean usage seems about equally divided, perhaps, with the odds in favor of 'baggage.' The Shakespearean coinage 'bag and baggage and scrip and scrippage,' which falls from the lips of Touchstone in 'As You Like It,' and which enjoys the familiarity of a household word, ought to have given 'baggage' a wider currency, especially in the author's own country. But language, like the heathen Chinee, has ways that are dark, if not tricks that are vain, and does not develop according to logic or our *a priori* conceptions. Between the Briticism 'luggage' and the Americanism 'baggage' it appears, therefore, to be a drawn battle. So the British have nothing to reproach us with on this score, since convention has adopted 'baggage' on one side of the Atlantic and 'luggage' on the other.

So much for this interesting class of Americanisms which repose on standard Elizabethan usage, but are social outcasts in the land of their birth. There is another class of Americanisms which are not bolstered up by a long literary pedigree, inasmuch as they originated on American soil and were not imported from the old world. As compared with the class just considered, these latter are mere *parvenus*, without any illustrious ancestral history to commend them. This class of Americanisms is composed of phrases which have found their way into our speech from various foreign sources. They have been introduced into our tongue from our contact with diverse peoples from remote parts of the globe. They constitute a small residuum of terms and phrases, the presence of which in our vocabulary attests the fact of our relations with different nations of the earth. For instance, in the early history of our country, we had to do with the Indians, and so borrowed from them certain terms especially pertaining to natural objects. We also had relations with the French, and consequently borrowed from them sundry phrases employed in official parlance, such as 'bureau of information,' for which British usage prefers 'office'; 'exposition' for the British 'exhibition,' and the like. Let these few examples represent the class. It is apparent here that we have made a slight departure from British usage. But it does not follow that our speech, for this reason, is less pure or less idiomatic. Both American usage and British usage show that the respective nations have decided to employ Romance importations in official language, but they have

adopted different terms for the same object. This proves, in the first place, the independence of the two great English-speaking nations even in the matter of language, and, in the second place, the wide-reaching influence of French as the recognized official and diplomatic language during the eighteenth and early nineteenth centuries.

In addition to these two distinct classes of Americanisms there is a third class composed of phrases and expressions which have not yet attained to the dignity of universal currency throughout the entire country. These are rather provincialisms which are peculiar to certain localities. This class, therefore, does not command the importance which the first two classes already considered do. In a heterogeneous population like ours, made up of people from every nationality under heaven, it is quite natural that in certain localities there should exist some eccentricities of speech, some departures from the received standard—in a word, some provincialisms. It need hardly be recalled that parts of our vast country were settled by other nations than the English, as, for instance, New York by the Dutch and Louisiana by the French, to mention two specific cases bearing on the point in question. The people of these respective states, when they were incorporated into the union, of course, did not immediately forsake their native modes of speech and inherited vocabulary for pure, unadulterated Saxon. When the vast southwest territory was made a part of the United States, the people in that quarter of the land spoke a lingo which had a decided foreign complexion. What more natural, then, than that in the speech of that portion of our land there should exist traces of this old foreign element? Assuredly it would have been the height of artificiality and an unprecedented proceeding for the French element of New Orleans, when they became citizens of the United States, to have renounced their native French names for such natural objects as 'bayou,' 'levee' and the like, in order to adopt pure Saxon terms. Likewise, it was not to be expected that the Spanish settlers in the western section of our country, specifically California, should abandon such native terms as 'cañon' and 'ranch' and so on, for the corresponding names of genuine English origin. Thus it happens that there is a pronounced foreign flavor, or at least a slight tang, in the eccentricities of speech heard in certain localities of the United States. But these are mere provincialisms and do not impair the quality of our standard speech, which is English to the very core.

However, it was inevitable that the English language in America should have received an influx of foreign words on American soil. But our speech possesses a marvelous capacity for assimilating non-Saxon elements from whatever source. Hence the various foreign elements, such as Indian, Dutch, French and Spanish, to mention only the chief importations, have all been absorbed without any appreciable altera-

tion in the constitution of our English speech, and only traces here and there are seen of non-Saxon elements surviving in a word or an idiom as an enduring monument to the influence of other tongues upon our own on American soil. Some of these foreign loans, it is true, are confined to certain localities, and consequently are to be viewed in the light of solecisms, or at best provincialisms. They circulate freely in a limited area, but are not recognized as legal tender throughout the length and breadth of the country. Such expressions are confined chiefly to the western portion of the United States and very rarely find their way east. It is questionable whether they are entitled to be termed Americanisms except in the most liberal interpretation of that phrase, because they are not everywhere current and are not readily intelligible, not 'understanded of the people.'

It seems appropriate at this juncture to say a word concerning dialects in America. The assertion is sometimes made that there are no dialects in America, that the railroad and printing press, the two potent and indispensable agencies in our modern civilization, have leveled out all eccentricities and peculiarities of speech and reduced our language to a uniform standard throughout our entire country. This statement is, in the main, true. Yet it requires only a little reflection to see that the assertion is not absolutely accurate and in accord with the facts. Certainly a brief residence in the several principal sections of the United States would bring convincing refutation. There is the western dialect, as implied in the comments in the preceding paragraph. There is also the Yankee dialect of New England, the salient features of which Lowell described very fully in his famous 'Biglow Papers.' There is no less truly the southern dialect with its definite peculiarities of idiom and utterance. These dialects are quite sharply defined by their respective characteristics of colloquial speech. Each dialect has its own phrases and locutions familiar enough within its own geographical divisions, but not readily understood, perhaps unknown, elsewhere. For instance, the native southerner 'reckons' and 'don't guess,' whereas the Yankee to the manner born does not 'reckon,' but 'guesses' *à tort et à travers*. As for the western dialect, it is said that three elements enter into its constitution, *viz.*, the mining, the gambling and the cowboy element, a rich vein of billingsgate running through each. An effort has been made by our writers of fiction to register and record the salient features of these respective dialects incidentally in their stories, but the shades and gradations of speech are not easy to reflect and preserve on the printed page with the corresponding local color. Hence the work has been but partially done, and nowhere with complete success.

We Americans are far less trammeled by dialectal inconveniences and perplexities, however, than are the English people. For in Great

Britain there is much less uniformity of speech than with us, and the difference between the language of a Scotchman and that of a Devonshire man is almost infinitely greater than the difference between any two American dialects. But the dissimilarity of the British dialects is historic and dates back from time immemorial. The story of Caxton, the first English printer, is well known, how the good merchant from a southern shire, when he inquired for eggs of a goodwife in a northern shire, could not make himself understood, his southern dialect being mistaken for French. To be sure, the dialectal differences are not so great to-day as they were in those remote times, largely as the result of the printing-press Caxton set up in Westminster. But even yet the differences between the dialects of the extreme parts of the British Isles is so pronounced as to be a barrier to complete interchange of thought.

It appears from the foregoing that the indictment of corrupting the English language which certain British critics have brought in against the American people is not a true bill, since no count has been established. Our British critics seem loath to acknowledge any American rights in our common language. Americans have as much right to enrich the English vocabulary with useful words as the English people themselves. We also have as just a claim as they to revive and preserve an obsolescent phrase or idiom. Because a given English word is no longer in use and esteem in England, but is recognized as standard usage in the United States, it does not follow that it is not good English. The number of those using the English language in America far exceeds the population of England, and the English speech is just as vigorous and virile in America as it is in the parent country. Indeed, it has given indubitable proof of its vitality and vigor on American lips by adapting itself to the infinite variety of new conditions in this new country and by the added flexibility, strength and richness as exhibited in its augmented vocabulary. English now is the language of the American people as well as of the English people. It is, therefore, no longer proper or scientific to speak of the queen's or of the king's English. Such a phrase is really an anachronism in the twentieth century, when the English-speaking subjects of King Edward are numerically inferior to those not owning allegiance to Britain's sovereign, who speak the same tongue. Moreover, it is manifestly not in keeping with the eternal fitness of things, as well as unscientific, for our British kith and kin to stigmatize an idiom or a phrase in good American usage as a provincialism simply because it is not current in Great Britain. The Britons have no more right to attempt to prescribe and limit the growth of the English tongue than we have. Nor do they enjoy an exclusive prerogative of determining whether a given expression, be it a new coinage or a survival from a former period,

shall live and flourish or decline and perish in the English tongue. No sovereign, no nation can determine this, either by decree or by statute. The most that the British can say in derogation of an alleged Americanism is that it is current only in America and is not authorized by British usage. But this does not make it un-English, if it bears the American sign manual.

It is perfectly absurd for the British critics to condemn Americanisms offhand and to attempt to read them out of the language, simply because they are not in accord with British usage. In so doing they give proof of their insularity and fail to exhibit a spirit of liberality and sweet reasonableness. Indeed, they seem disposed, at all events, to take themselves too seriously as guardians of the English language. It is well enough for a critic to throw his influence on the side of the preservation of the purity and propriety of speech. But it is sheer folly to allow one's pedantry to go to such a length as Malherbe, that 'tyrant of words and syllables,' who on his death-bed angrily rebuked his nurse for the solecisms of her language, exclaiming in extenuation of his act, 'Sir, I will defend to my very last gasp the purity of the French language.' It is related of him that he was so fatal a precisian in the choice of words that he spent three years in composing an ode on the death of a friend's wife, and when at last the ode was completed, his friend had married again, and the purist had only his labor for his pains. Now your true British pedant seems to think it his bounden duty to reject summarily every word or expression which does not bear the pure English hall-mark, and that as for Americanisms they are an abomination which must inevitably work the speedy corruption and ultimate decadence of the noble English tongue. Such an one, whether from his precisianism or his prejudice, fails utterly to recognize in Americanisms conclusive evidence of the inherent potency, vigor and vitality of the English language on American lips.

DIFFICULT BOYS

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A LONG and somewhat intimate acquaintance with boys and teachers of boys, many of whom are my close personal friends, has given me opportunity to formulate certain conclusions which may help others. I have always been fond of the society of boys, being endowed with youthful tastes and aptitudes, and find it profitable to study boyhood hopes, pleasures and ambitions. I have also taught boys and traveled with them in various capacities, and have a grown son whose friends I have tried, and with some success, to make my own. My personal work has brought me in intimate contact with many phases of the human mind other than normal and particularly with problems of psychologic imperfections. This attention to abnormalities of the mind and character has not had the effect of making me over-suspicious of finding defects of the mental processes, because it is obvious to the student that few brains are free from obliquities and regrettable limitations. The tendency is for me rather to view with tolerance inevitable vagaries which surprise and shock those who assume that the mind of most folk is sound and dependable. Teachers and parents are overready to become amazed at sudden variations and deviations in the thoughts and actions of those entrusted to their keeping. Kindergarteners seem to assume as a fundamental principle that any child subjected to what they define as suitable conditions of environment and education can develop into a perfect being. Lawyers divide people into two sharp-cut classes; those who are altogether sane and responsible, in season and out of season, and those who are insane, fit only to be held in check by restraint. Clergymen are over-tolerant of peculiar action and speech, often to a degree that they are not so helpful as they should be in enforcing authority where capability for responsibility is questionable. They frequently urge the objection that a stigma falls upon those who are at any period admitted to be in need of special training or restraint. Among medical men there is too little knowledge and much unwarranted fear of mental problems. They know something, but not enough, as a rule, and occasionally err on the side of condemnation.

Physicians and teachers should clearly appreciate that the mind of man in his earlier years varies widely in degrees and qualities of development, even more than in differences of bodily growth. Again, varying conditions of home influence, early schooling or accidental train-

ing may, and does often, bring forward rapidly one part of the mind while another remains distinctly infantile. Conditions of bodily health, not always obvious or even readily estimable, produce profound changes in cerebral energizing, so that one day certain beliefs, capacities and limitations may exist and to-morrow the balance of power be far otherwise. Under certain conditions, not readily determinable by common criteria, we may note and encourage in some the most bubbling spontaneity, and in others similar circumstances may check all this, inducing introspection, discontent with self or surroundings, even a brooding melancholy. Tastes and inclinations differ enormously, especially in boys; also standards of excellence. Conceptions of objects worthy of pursuit in sport, or study, or plans for life, are often widely at variance, not only in different individuals, but in the same boys at different times and under dissimilar conditions.

Many boys are possessed of greater fixity of purpose than others. This is usually assumed to be an altogether desirable quality. Not always so, because one boy may possess a nature large with possibilities and varied capacities, some of which are bad, revision being most desirable. It would be a deplorable unfairness to compel such a one to become molded into a definite form before time and circumstances have permitted a symmetric shaping of the best several parts of a complex organism. It may be that such a boy will require many years of opportunity and training to furnish scope to vast inherent powers for good. Put him into a narrow line, and only warping and possibly embitterment and deterioration follow. However, fixity of purpose is to be welcomed in the main, because direction can be given to strong impulses; but it is a hard task to steer a drifting ship.

The subject is so wide and capable of being treated under such a variety of headings that my purpose here is only to offer from my experience remarks upon two of the chief influences which either make for corrective development, or emphasize the original bent and impair usefulness and citizenship. The one is home training and early environment, the other is the school and the teacher.

A long experience in the specialty of diseases of children has brought me in contact with many children in their homes. A large and important book could, indeed should, be written on the subject of parenthood. In a paper I wrote some years ago ('The Nervous Mother,' *Univ. Med. Mag.*, N. Y., 1895) I said:

> We all love to contemplate our eidos, or highest concept of the mother, the unspeakable beauty of which has alternately lured and baffled thinkers and poets throughout recorded history. Nothing is too good or can be claimed as too lovely in description or praise for the ideal type of maternity. It is then with regret we must admit that the average mother is often disappointing. It has been permitted me to meet many superbly beautiful mothers. Yet this

crowning embellishment and glory of womanhood comes too often as a surprise, nor is it always welcomed, and only rarely does it bring unalloyed joy.

There are obviously some faults here which must be local or due to remediable conditions. It is our duty to search out the defects and correct them. This in my judgment is chiefly in negligences in teaching mothers their duties. When it is realized that the most valuable influential impressions upon the infantile organism (whereby standards are acquired, moral impulses initiated), are made during the first year of life, it is plain that no omission of maternal care can be otherwise than hurtful. However much the mother may lack of perfect fitness for her sphere, however blameworthy in her attitude toward her trust, still she is a trustee for whom there can be no substitute comparable to herself. The child who has failed to enjoy the tender all-enfolding care and love of a mother, acting up to her best endeavors, is bereft of the greatest gift obtainable. She may leave in her personality, in her conduct, much to be desired. She may be a mass of minor faults, not wise or strong of mind, yet if she be sincerely desirous of fulfilling her instinctive obligations, no other being can replace her.

The difficult boy stands clearly differentiated in my mind from the backward-minded or irresponsible boy, although there are grounds on which they may become merged. The difficult boy, as I conceive him, is one endowed with normal impulses, usually overstrong, which, because of defects of early guidance, have become diffusive, unsymmetrical, lacking inhibition, one who is commingled of more bad than good, yet often capable of great things under favorable conditions. There are those in whom the ingredients vary in other directions, among the worst of which are apathy, laziness, secretiveness, moral shortcomings. These, however, will soon or late become classifiable differently.

The difficult boy may appear to be a liar, a bully, selfish, unwilling to exert himself in worthy directions, of even other and perhaps worse characteristics. All this may be due to pressure of circumstances obtunding a none too vigorous sense of right and wrong, distorting conceptions, inducing acts and speech which belie inherent normal instincts which are undeveloped or chronically impaired. In short the seeds of wholesome manhood are present, in fair measure, capable at times of splendid development, often to admirable citizenship, but not strong enough unaided to nullify the blanketing effects of circumstance. How are we to estimate what these counteracting forces are, or were, in the instance? How should we have conducted ourselves under the same baffling influences? What would have been the effect of the same plainly indicated disheartenments, evil influences, examples on one nature as compared with another? If we examine our own personalities, we can see evidences of effects springing from apparently trivial causes out of

all proportion to that which should have followed. A critical, candid self-survey will often astonish and alarm us at the close escapes we have made from impulsions which swayed us forcefully. What consequences have we escaped by sheer accident? In short, how can we wisely make allowances for forces potent in others, the nature of which we may only dimly know and are practically unable to appreciate in all their temporary despotism? The question is how far will the normal impulses carry any one? We plume ourselves on our own individual solidarity, poise, achievements, our importance in the community; yet we have survived endless perils by means of some judgment and more luck.

G. Stanley Hall, the master mind in childhood psychology, tells us in this connection that:

> Many of the morbid mental phenomena are merely those of overaccentuation of processes normal at puberty. The germs of many of these disturbances lie in the common faults of childhood, which are now studied under the name of pedagogic pathology. We must seek the key to these perversions by addressing ourselves to the larger underlying and preliminary problems of determining the natural forms of psychic and somatic transitions from childhood to maturity, and study what puberty and adolescence really mean as developmental stages of human life.
>
> Adolescence begins with the new wave of vitality seen in growth; in the modifications of nearly every organ; new interests, instincts, and tendencies arise, increased appetites and curiosity, so that it is the physiologic second birth. Passions and desires spring into vigorous life, but with them normally comes, or should come, the evolution of higher powers of control and inhibition. The momentum of inheritance may be sufficient and Binschwanger conceived the psychic morbidities of this age as due to exhaustion or lack of capital.

In the earliest education of all boys, whether in the family, the kindergarten or the school, one definite principle, it seems to me, should be held in mind as of paramount importance. This is motor training. The potentiality of this postulate is readily demonstrable, yet the history of education exhibits here a neglect, seeming to argue that if the principle were so vital it would have been enforced long ago. There is some modification in these later years. Froebel makes partial use of motor training in his beautiful idealizations, but it is subordinated to an optimistic expression of the good, the beautiful, the divine, needful but lacking in robust practicability. Man is put into the world to do something, to be something, and the obvious way to accomplish this is by primitive forms of labor. He may, and should, think, worship and aim for high ideals. In all this he should achieve concrete things. It is by no means proved that he can do this, except through the gradual process of fitting himself to become a practical part of the divine scheme. In this there is no place for drones. In due time he may devote himself, after earning the right, to physical quiescence, to thought, to contemplation. Man may, if he so elects, try to achieve a serene mental attitude (nirvana or kaaf) until

he shall become released from all bonds as the teachings of Brahma make possible. This is what the Froebelian conception leads to.

Action is the key-note to habit and character. Good habits make for progress. Habits are definite actions resulting from sensations, motor modifications in nervous matter which have become stable through repetitions of actions. They are thus more easily performed. At first there is friction between sensory and motor nerve cells and this must be decreased by work. Memory is thus the same as habit; the nerve cells continuing to act in the way they have been induced to act before. We remember most easily things or acts which have been most often performed; new paths are thus ploughed out in nervous matter. When actions have been repeated often enough there are then almost no new paths to be formed. Hence habits acquired become fundamental courses of action, they constitute organic memory, which may or may not be accompanied with consciousness. To form these there must be *accurate repetitions of dynamic associations between nerve cells in early life,* during the plastic period. After plasticity of these cells has passed away guiding habits can only be acquired imperfectly, and if at all at enormous expense of energy. Hence the imperative need to form correct early habits, which are bundles of memories or tendencies enabling us to act again in the way we acted before. They become parts of our essential nature. A man does in middle life what he began to do in childhood—it may be good or bad—it is imperative. The boy unconsciously molds and trains his nervous mechanisms in such fashion that they will continue to act and react in the same way. At the start he is master, after a time habits master him. When these facts are more clearly appreciated there will be broader acceptance of the truth of the principle that dogmatic authoritative training in early life is best, provided always parents and teachers can be trusted to initiate action judiciously. Many a man is a failure in some direction, because he omitted to acquire the habit of courtesy, self-restraint, correct diction, punctuality, dexterity, accuracy in fundamental motions, even truth-telling. What evil may follow from the acquirement of vicious habits, however heroically resented, can readily be imagined. Habit is the process of associating a definite muscular action with a sense impression or with an idea. A child properly trained gives the right motor response with unerring accuracy. Sensation must be associated so often with action that one shall flow automatically into the other. An image is a revised sensation leading to mental conceptions, impulses, etc. No image can be formed without causing a more or less intense motor outflow. Movements can be checked by the introduction of cause, and counter cause. Thus the will is invited to oppose a movement through the function of inhibition, whereby it is modified in accordance with judgment.[1]

[1] See Reuben Post Halleck, 'The Education of the Central Nervous System.'

The child of rapid growth usually fails of symmetric development in several directions. Disease processes, infections, accidents of nutrition, environment, emotional influences, etc., all tend to initiate and emphasize minor deformities. Overgrowth usually leads, for instance, to poor thoracic capacity. If the thorax is for any reason disproportionately small and narrow a variety of special predispositions are encountered.

If as physicians we fail to devote sufficient attention to morbid phenomena of the mind and morals, we perform less than half our duty. Disorders of the mind are dependent upon one of two factors: either defects of development in the brain, or diseased processes of the brain, or retroactively. The purpose and aim of diagnosis rest upon the concept that by the early recognition of manifestations of morbid physiology, we shall find means to check the changes which would otherwise pass on to destructive alterations.

If this proposition obtains for the disorders of the physical functions, how much more must it fulfill a valuable service for those of the brain, which is a far more sensitive structure and especially liable to permanent damage from relatively slight irritations. It is a great privilege to mitigate bodily suffering, to limit the progress of structural degenerations, to prevent disablement and save life, but how vastly higher is the prerogative to turn aside those perils which jeopardize the budding intellect and rescue a tottering moral nature. Yet how little of this subject is the medical student taught, or again how much interest does the average practitioner display in this incomparably higher phase of his duties?

It should be the aim of the clinical teacher to emphasize unceasingly the urgency of obtaining the earliest possible indications, omens or prefigurements of departure from normal functionation; especially in children. When this is accomplished the greatest economy is effected; first in the limiting of suffering and the progress of disease, and second, in forefending the organism from developmental defects. All life is a process of development, but the effects of interferences are vastly more forceful and significant in the young. M. W. Barr points out a fact, especially obvious in children of impaired mentality, which, however, obtains to a certain extent in all. There are at any one period, three ages which must be estimated: (1) the actual age in years, etc.; (2) the psychologic age, the degree of mental development or retardation; (3) the physiologic age, the status of conformation and function.

Diagnosis of the morbid conditions of childhood involves something more than a mere search for evidences of disease. During the period of plasticity numerous influences prevail in all ranks of life to alter normal growth and organic development by which the foundations of constitutional weakness are often laid. These are in a great measure

preventable, at least in part. It is the duty of the physician to recognize and promptly rectify the evil effects of environment and training, and in so far as possible of inheritance. Hence it is a most important department of differentiation to possess clearly defined standards of growth, proportion, activities, sensitiveness, functional competence, intelligence and capacity for endurance. These standards should be the product of wide observation, reading and experience, among normal as well as abnormal conditions, but unless tempered by judgment, right conclusions are not assured.

The prototype for each teacher and physician is the ideal child, a composite picture of normal children, and can not be formed too carefully by a thorough interpretation of all data at command. Next to the ideal child the teacher should erect for himself standards with permissible variants. In America we must not limit our attention to children of pure Anglo-Saxon stock, but hold in view the many other racial characteristics with which we are likely to come in contact. There are crosses of the Latin, Celt, Slav, German, Hebrew and other white races; also the hybrids of red, yellow and black races. These modifications exhibit laws of their own, as yet by no means clear, but deeply significant. Inheritance of tendencies is recognized as a potential factor. Predisposition to physical and moral derangement is an obvious factor, admittedly forceful for harm.

Difficulties of differentiation are many enough among children normal in structure, in neural balance and in mind, but these grow greater where constitutional variations or deviations are present. Hence it is desirable to weigh variants in type, such as peculiar and exceptional children. The normal processes are profoundly modified by peculiarities of temperament due to inheritance or acquired. E. W. Bohannon in a statistical study of over 1,000 children (*Pediatric Seminary,* Oct., 1894) covers the ground sufficiently to warrant using his classification. The psychic factor demands deeper attention in pedagogics than ordinarily obtains.

Bohannon formulates certain types of mental and physical conformation:

> These types are the heavy, the tall, the stout, the small, the strong, the weak, the deft, the agile, the clumsy, the beautiful, the ugly, the deformed, those with birth marks, the keen and the mentally precocious, those with defects of sense organs or mind, the nervous, the clean, the dainty, the dirty, the disorderly, the teasing, the buoyant, buffoons, the cruel, the selfish, the generous, the sympathetic, those with imagination, the liar, the ill-tempered, the silent, the dignified, the frank, the loquacious, the inquisitive, the courageous, the timid, the whining, the spoiled, the gluttonous, and 'the only child in a family.'

Many of these types cross; several are liable to include similar features, constituting composites of the types, making the study somewhat complicated if carried to legitimate conclusions.

A review of Bohannon's findings and conclusions from the observation of this large group reveals much of practical interest. As to general health and mental ability there appears good reason for believing that the larger children, except the extremes, are superior to others. But it must not be forgotten that there are pathologic cases in this group, especially in those showing marked departures from the average. Those who suggest too early maturity are generally even-tempered.

Small children evidence delayed development. The less vigorous show degenerative phenomena, many are delicate, ugly, deformed, or vicious, dull, mean or spiteful, and tend toward morbidity. The strong children, while exhibiting many admirable qualities, are likely to be aggressive, harsh, coarse, rough. More is expected of them, hence they are often early exhausted by compulsory work; their offenses are the result of excessive, often explosive, energy. The weakly children are likely to show pronounced evidence of degeneracy, often they are ugly and deformed, cruel and mentally deficient. Inheritance was not so frequently recognized a cause as parental follies, especially during the embryonal period. Temperamentally they are usually unfortunate.

The deft and agile show better health, yet are undersized. Clumsiness is found due to two causes; first, want of development of the mechanisms which function the accessory movements; and second, excessive inhibition of the same, along with lack of emotional balance. Ugliness is usually accompanied by many evidences of degeneration, physical and mental; in the deformed these deviations are even more decidedly present. Deformities are largely (*ipso facto*) manifestations of deviation, defects of central development exhibiting anatomic and physiologic faults, some of which are remediable. Under good care many of these improve greatly, some becoming distinguished adults. They are found to be treated by parents and associates with amazing lack of consideration, hence they suffer temperamentally.

Among those showing defects in mind, sense organs and speech, there is much to indicate a general decline. They are morbidly retiring, dependent, and lacking in symmetrical development, due in part to original defects and deficiencies in normal stimulus.

Those children grouped as 'nervous' exhibit delicacy and instability of constitution, are deficient in size and vigor, are timid, sensitive and changeful, disposed to be irritable and meddlesome, defective in control, hence untruthful. The extremely over dainty and the distinctly dirty, each excite suspicion of mental abnormalities. Buoyancy and teasing both indicate excess of energy; so also of cruelty, but here ancestral traits seem manifested.

Lying and imaginativeness are allied, and point to lack of self-control or to selfish imitation; the associated traits are disobedience, ill-temper, thieving and bad health. Those who are peevish, untruthful,

discontented, are usually of delicate make and evince instability and poor vitality. Those who are loquacious, voluble and inquisitive lack inhibition or control.

Courageous children are usually healthy and strong in mind and body. Timidity has a physical basis, but may be acquired from bad environment, habitual discouragement. The 'only child in the family' in 66 per cent. shows disadvantageous traits; they are usually of poor health, lacking much of normality, both mental and physical. The 'youngest child,' the 'only boy' or the 'only girl' often displays many striking resemblances to the 'only child.'[2]

Classification of grades of mental deviation is only important for purposes of teaching. Types of mind there are, and they must be fully appreciated that individuals may secure the right kind of influence and training. Degrees and qualities of mentality are even more important, because by this means we may know where to place the individual, how much control to insist upon, how much compulsion to exert on the parents. Types of all the adolescent insanities merge into each other. Those who have the charge of young children may have no need of psychiatric training, but they do need to employ a common-sense recognition of abnormalities, deviations, obliquities, patent enough to the intelligent observer. Children of pronounced dominant impulses may exhibit at times self-will, naughtiness, ill temper, even exuberant imagination to the point of mendacity, buoyancy or apathy in changing moods, and yet become wholesome admirable citizens. Distinct and continued nervousness, fretfulness, timidity, brooding, causeless variations in moods, cruelty, vengefulness, should put us on our guard and warrant suspicion of deep-seated perturbations foreshadowing psychoses.

Educational methods are still defective in many particulars. Tradition holds us in a powerful grasp. In the public, and in most private schools, the course of study is analogous and aims to meet the supposed needs of the child of average intelligence. This would be well enough if certain fundamental truths were recognized by both school boards and parents. Custom has created a public opinion from which it is difficult to appeal. For instance, it is a fact that all children develop on some lines more rapidly than on others, in differing degrees of rapidity. In one there may be exhibited early motor aptitudes with late intellectual capacities. In another the reverse, yet at a certain age they may be to all intents equal. One child may acquire language, grammar, and the elements of literature early, with a late grasp of numbers, arithmetic, the natural sciences. Another may reverse this, and yet at a given time these two may be on a par. It will be plain that to get the best results due allowances should be made

[2] See article by the author, *Brit. Jour. Childrens' Diseases*, January, 1905.

for these variants. In some schools full cognizance is taken of these normal peculiarities. Economy, however, demands that all children of about a certain 'grade' shall pursue a 'systematic course.' The product is not what it should be.

The personal influence of the teacher is recognized increasingly. In some of our colleges a plan of subdividing the classes into small groups and placing them under tutors has been found of largest value. (At Princeton University a modified Oxford tutorial system was first initiated with excellent effect by Woodrow Wilson. This is now adopted by several other colleges.)

Indeed valuable horses and dogs get more careful personal teaching than most children. Boys whom we characterize as 'difficult' have become so largely by neglect or postponement of some important item of education. They have become warped, unsymmetric, psychically and physically. The prevention is right education, so also is the cure. The first thing is to correct faults of misdirected impulse, the next is to teach the elemental principles of self-restraint, disentangling errors, illuminating doubts, always encouraging and leading to wholesome customary lines of action and thought. Endless difficulties would be prevented, boundless good would be afforded, if from the earliest teachers to the highest university professors there should be pursued some uniform plan of notes or records on individual aptitudes, tastes, tendencies, capacities. Some teachers are endowed with instinctive capabilities for meeting unusual problems. Some also, the majority, are astonished and distressed, even annoyed and resentful in the face of individual peculiarities, good or bad. No one should judge too soon whether the peculiarity be altogether good or bad.

Errant impulses are by no means understood. Geniuses have exhibited strange individualisms. They are rare (geniuses), it is true, but how many times do well-meant efforts to suppress spots on the leopard, or to paint out the stripes on the tiger, fail to make of a well-bred wild cub a respectable tabby cat. The power of a nation resides in men of individual dominant personality.

We want our boys and young men to have ample opportunity to evolve their own individualism. University curricula are now made increasingly liberal. Why should not the primary schools adopt similar principles? It is quite true a 'system' is desirable for the average boy, but a sliding scale ought to be within the reach of any one who is recognizably unfit to pursue the customary methods.

Our 'difficult boys' may be divided roughly into those who are provided with overmuch impulse or too little, the robust exuberant doer, or the torpid dreamer. It is obvious that each needs motor education, partly similar and partly diverse. The chief defect of our school system is the lack of opportunity for motor education. In country dis-

tricts where boys acquire of necessity more of handicraftsmanship they need manual training less. In cities it is essential.

The boy of mental peculiarities will not settle down to efficient work till he finds his own place, his level, range of action, and by his own initiative. This discovery is always the outcome of a gradual evolution; it should not be forced. From this secure position, once attained, he can fare forth satisfactorily and finally achieve his adult sphere of usefulness. That boy is fortunate who is content with his own province when discovered and does not invade that of another. Many a boy fitted to make an admirable and happy ranchman, soldier, sailor or farmer becomes a misfit self-detesting clergyman, physician or lawyer. His early advisers are generally to blame in compelling him to masquerade as a scholar, who was formed to be an excellent capable every-day man. Intelligence, capacity, is not to be measured by degrees so much as by qualities, aptitudes, characteristics. A first-class foreman in a factory may possess a far more symmetric intelligence, a clearer judgment, than the lopsided genius who invented the objects which he manufactures.

One of the surest criteria of capacity, at any level, is, according to M. W. Barr, the grasp, the quality of the grip of the hand. The grasp shows many things indicating the comprehensiveness of the mind. Certain minds can readily learn by doing, yet they grope feebly in pure intellectual effort. They reach an equally worthy goal if only they know their limits, stop at their own station, go to their own home. Over-stimulation in scholasticism is as hurtful as overtraining in track athletics; the staleness may pass into permanent mental impairment.

Shyness, inertia, resentment of interference, timidity, gloom, indolence or stubbornness may indicate no essential defect, but may be due to awkwardness, defective coordination. The cure is kindly encouragement, guidance in activities, development of unrecognized aptitudes, praise, wholesome incentives. Many have little tactile sense; this should be encouraged in all ways; it may finally come in fair measure and form the ground for conspicuous abilities by cooperation of other faculties long overshadowed. Barr quotes Buffon 'how wonderfully the senses are alike at bottom, how they supplement each other!'

The limit of receptivity is often reached early. It is then wise to be content with careful training on a lower level in which excellent capacities can be attained. One man can become a thoroughly good soldier, to obey orders, to die at his post, to follow to the death, who never can lead a company, much less plan a campaign or sail a ship. The best captain is by no means necessarily a good oarsman or a gunner. *Always it is essential to achieve even qualified success to begin special training as early as possible during the plastic stage.* No good sailor can be made from an old farmer or an old professor of mathematics.

The most promising agency in eliminating the difficulties which impair manhood in boys, future men, citizens, is the kindergarten, the principles of education outlined by Froebel. This aims at the highest idealization of life, largely through the play instinct. Whatever criticisms are made on the kindergarten teaching can only hold against methods of application. So far these objections have to do chiefly with its lack of adjustability to established educational methods, and will cease when the exponents of Froebel acquire greater breadth of knowledge, a clear appreciation of the practical needs of society. Our established methods of education leave much to be desired, but it will take time and thought to bring about a perfect system. Meanwhile it seems plain that the one means of both prevention and cure of difficult boys is to be found in a perfect home.

The ideal home, where two parents live with and for their children, where mutual helpfulness is fully afforded, where the fundamental impressions are given and received, is the greatest agency in primary education. Unfortunately this ideal home is made difficult of attainment because of a multitude of factors, especially in large cities by altered, artificial, perverted methods of living. The instinctive natural helpfulness, so necessary to arouse the sense of individual responsibility, finds little opportunity for growth. Unless the boy is encouraged to bear his part of the burden, to contribute his share to the body domestic, as in the primitive home, he can not grow symmetrically, or become certain, exact, in his more robust impulses. Instincts of responsibility find small encouragement.

To be sure, we can not check the inevitable trend of modern industries which aim by over-specialization to reduce the individual to the rating of an intelligent machine, whether in the lower or in the higher industries. If, however, we can succeed in fostering the spirit of the home, in implanting early, in the plastic childish brain cells, the idealities, the desirabilities of home, much will then be accomplished. Admitting that the conception of the home, once implanted, is forceful for so wide an influence, let us waste less time in other directions and concentrate our efforts on erecting and preserving the ideal of the home. This the teaching of Froebel is capable of accomplishing. The concept of divided responsibility is constantly presented. Pictures of domesticity, object lessons in practical helpfulness, are parts of the course of instruction. Children taught on this principle will carry through their lives clear ideals of home. When they become parents these instinctive promptings, these deeply suggestive pictures, early implanted, will act as unerring guides to parenthood.

The first thing a troublesome boy must learn is unquestioning obedience. In this way he may become a perfect intelligent machine.

Not, however, if he run wild and lawless till manhood, or not then without endless pain and punishment can he learn his life lesson. All good in human beings comes from seizing and utilizing the period of receptivity to all manner of impressions, the formation of habits of obedience, of accurate response to orders, to the facilities of craftsmanship. This is highest at birth and diminishes in a parabolic curve.

The boy physically strong, but intellectually weak, should not be judged by the same standards as the one physically weak but intelligently keen. Each will tire in his line of defects before the complemental capability has time to assert its potency. Neither should he hastily be judged inferior, because within his sphere he may be worthy of confidence and equally useful. Barr thinks that the stimulus of music is equal to that from books. The ever-present sensitiveness to disharmonies is developed by rhythmic sounds as well as by military drill. As energies are developed they can be specialized, directed into suitable channels, to varying applications, if not falsely forced, only wisely encouraged.

The problem of educating the tumultuous, effervescent or exasperating boy is usually solved by the military school. The enforcement of implicit obedience, the sharing of responsibilities by boys acting as petty officers and many other features constitute satisfactory methods, in the main sufficient. They often lack something essential. Soldierly qualities in the teachers may be absent, they being not themselves adequately trained for their accidental rôle. Again the routine of an ordinary school, constructed on military lines, even those of governmental foundation, often fails, because the industrial feature is absent, the only relaxations being leisure, or the ordinary athletic games.

Probably the best means of making clear the ideal methods, so far as we can adduce them, is to cite the course of training at a school where the best results are attained; where the boys, all difficult problems, yet become developed into, not only useful citizens, with rarest exceptions, but some of them achieve high qualities although their early status was desperately bad. The one in my mind is the Glen Mills School, Pa., originally the House of Refuge for Philadelphia. The boys are only admitted when committed by the law after perpetrating overt acts. Every one is of the most difficult kind. The special features of the Glen Mills School are the paternal, intellectual, agricultural, industrial and military. Other schools there may be conceived on a similar system, but I am safe in claiming that nowhere are these features in all branches so consistently and thoroughly carried to a legitimate issue. None achieve such uniformly satisfactory results. One item of equipment is superior, a magnificent gymnasium, the gift of Mr. Alfred Harrison. Here the boys enjoy every opportunity of a gymnasium, a drill hall, indoor games, basketball, preliminary baseball

and football, etc., and a splendid swimming tank; all under expert instruction. The one element of industrial training impresses me as the most important of all. The boys make all their shoes, clothes and many other essential articles for home consumption; all furniture needed or desired. They decorate in highly artistic fashion all walls for esthetic and sanitary reasons and add to buildings, as the two new wings of the schoolhouse built last year show. Agricultural instruction is not only the best form of physical training, but a constant source of object lessons, the wholesome means of correction and moral stimulation. The week's work is divided judiciously between these various industries, and always, daily, certain portions of scholastic instruction, military routine, drills, etc. The scholars live and sleep and eat in houses presided over by the teachers and their families, securing the paternal influences.

In conclusion let me urge all those who are charged with the care of a difficult boy to be openminded at all times; to be prepared to modify the original concept, the earlier estimate; to read him in the lights revealed along the way. Above all things exercise toward him companionability; encourage confidences, especially as to hopes, ambitions, views on life. Be quick to see the good, the forceful, qualities and help the spontaneous exercise of these. Above all never be betrayed into forcing on such a boy plans of action contrary to his bent, his tendencies. *Let him evolve a course of action,* help him to perfect it, be it large or small. The small may become elaborated, the large may need modification. When the course is chosen, emphasize, praise, encourage spontaneity. Always leave the door open to a return to you for renewals of stimulus; encourage the appeal to you for judgment, for wisdom.

GENIUS

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CONSIDERED genetically, intellectual and physical functionings oppose one another. The business of organisms is to act. And action means primarily a direct response to stimuli. It is only as the organism grows complex and there is opportunity for more than one reaction to a given stimulus that there comes about a retardation involving an inhibition of action. And this retardation is filled out with weak reflections of the nerve paths which are being stimulated, *i. e.*, with thought. Thought, then, comes at the expense of the organism's natural functionings. Thought brings bodily inertia. Were there no thought, we should be mere reflex organisms. Health is conditioned by physical acts and the healthful rest of the organism is accompanied by sleep.

Now all this means that we who think are in a sense artificial folk. We are transcending nature in a way—at least in comparison with the great mass of animal life which has a more or less reflex existence. Still we have our compensations. We are *knowing* beings, having two sides to our natures, a physical and an intellectual. We can react on a given presentation in two ways, either intuitively in accordance with our natural physical bias, or logically in accordance with our more artificially developed reason.

It is no mere matter of hyper-intellectualism which leads us in our genesis from the first to the second of these modes of reaction, but a matter of increasing complexity of the organism making simple intuitive reaction more and more impossible. Therefore, as a general proposition, this development is nothing we can or wish to strive for or against. We simply have to accept it as it is.

Yet, turning to the study of individual man, we find great diversity of mental bias and disposition. The happiest and healthiest of men is doubtless he who lives an active life out in the fresh air and amid pleasant natural surroundings. His physical bias is strongly developed and affords a ready and never-failing intuitive force for good and health. His mental outlook is clear if not profound. He takes things as they are and, unless accident befall him to disturb his habitual methods of functioning, he is able to meet the various situations of life with positive equanimity.

On the other hand, he who by reason of physical inefficiency or environmental conditions spends his life in inhibiting physical action, finds a substitute for action in thought.

The intellectual life has two main attitudes: active reasoning and esthetic contemplation. Though these two complement one another, we find them variously accented in different individuals. The scholar leads, in the main, an intellectual life, yet the esthetic complement to his nature may be very slightly developed. His reasoning processes have the aim of elucidating and, therefore, of bringing peace of mind with respect to some phase of life. But his pleasure is more largely in the business of thinking, in the solving of his concrete problem, than it is in the contemplation of a complete result such as characterizes the esthetic attitude. The true artist has his esthetic ideal always before him. His function is to express this ideal as a complete and conformable whole. Whether his work be of head or of hand, it is always informed by such an ideal and the artist's genius rests all in his ability to give adequate expression to this ideal.

Each of us has these esthetic ideals in some degree, but only a few of us attempt to express them. We seek, rather, an expression for them in the work of another and, finding it, we obtain esthetic pleasure in the contemplation. But he whose ideas become crystallized to such an extent that he can objectify them and give them expression in a picture, a drama or a symphony, he has a peculiar talent which the rest of us, however esthetically appreciative we may be, do not possess.

The genius must possess a certain technical skill to enable him to express himself objectively, and he must also be so imbued with the force of his ideas that he is, in a sense, impelled to give them such expression. This *necessity* of artistic expression is one of the factors of his esthetic nature. A demand is felt to realize a certain ideal, to give it a clear objective expression such as must always be lacking so long as it remains clothed only in the vague imagery of the mind. The hack author, painter or musician may make a mere business of his talent. In so far as he does this his work must be of low merit as art. It is forced rather than spontaneous. It caters to an audience instead of being a natural expression of his own ideas.

There is something very intimate about true art. It always expresses the man behind it and, in the last analysis, its merit is a token of the character and mental bigness of the artist. Those who have no clear and definite ideas, but busy themselves with vague intentions, only reflect in their works the unrest of hyper-sensitive natures. We, their audience, may recognize and sympathize with their unhappy states and, indeed, derive a certain esthetic enjoyment from their expression, but it remains for the man able to give a positive impetus to

his work to be termed a *genius;* one possessing a certain sublimity of purpose and accent which brings his work into touch with the eternal.

As to the artist's technique or means of expression, it must always take a place subordinate to the idea. The idea is always the motive power, the dominant force. So soon as the artist's interest lapses into an active pleasure in his work as such, he loses sight of his aim. And this shows quite conclusively that no amount of skill and special training in expression ever makes an artist and, indeed, explains the artistic puerility of so much work produced by men of splendid technical equipment. The pernicious influence of the 'academic' training is due to just this, that the artist is led to see the value of his work in such beautiful lines and relationships of form and color as all can imitate, rather than in an individual idea clamoring for artistic expression. Thus it is that much of our greatest work is expressed in crude, unfinished form, at times by men who apparently knew not how to express themselves completely or, at least, *would* not; for example, Rodin, Michelangelo, Manet, Whitman and Richard Strauss. Yet the force and dominance of their esthetic ideas justify and lend a value to their work higher than that of any faultless academician faithful to his classic traditions.

The true genius never learns his art. It is intuitive with him. There is but one way of expressing a great thought adequately and that is naturally, therefore intuitively. So soon as the artist begins to reason as to how he shall express himself, he loses sight of that which he has to express. His process is no longer an esthetic one, but becomes a practical one. Except to introduce a person into the realm of art, to teach him some of its manifold possibilities, art training is a thing of doubtful value. In so far as it attempts to substitute rules and methods for one's natural intuitive ways it is positively detrimental. The artist must be first and foremost an individual; without individuality he certainly can never be termed a genius. Still, if he can not be taught as one is taught a trade, he can be taught clearness of thought and perception, and this should be the true function of his training.

When we interpret things too much in the light of our knowledge concerning their objective natures, we usually interpret them wrongly. It is only when we understand them subjectively as 'experience' as well as objectively that we know how to represent them adequately. The best means of expression is the intuitive and natural, but a true psychological knowledge may aid one's expression when too much experience and reasoning has interfered with one's natural intuitive bias.

We find, then, that our true artist is a person of esthetic ideas plus an ability to express them adequately. Now, what are the consequences of this mode of mentality on the life of the man?

We have noted the artificiality of intellectualism as compared with naturalism. There is something even more absorbingly intellectual in the artistic mode of life than in the scholarly, for in the latter one is occupied with a *process* more or less limited in scope, whereas the artist is always striving to represent a complete ideal. The effect of this on the artist's active life depends largely on his natural propensities. Esthetic contemplation has evolved genetically out of sensationalism, and it is doubtless the sensual factor in his nature which leads to most, if not all, his pathological tendencies.

Moral and utilitarian ideas can scarce be other than healthy when viewed either from an esthetic or a practical view-point. Sensualism, however, is decadence. The effort of the individual to give free expression to his senses is always met with failure. Having risen above our mere sense natures into the realm of intellect, it is now impossible to revert to them. The clear, happy, unaffected, hedonistic lives of the Greeks are no more possible in these days of modern artifice. Therefore, he who turns to the senses for a true expression of his nature finds his effort clogged with all manner of false and related concepts which his experience with society has thrust upon him. There is no way to live 'naturally' in our day.

What, then, is the fate of him who attempts it? Taking all things in life to be natural expressions and being interested more in the states of body and mind than in any particular results to body or mind, this person is led to seek peculiar complexes of sensation, peculiar situations, bizarre effects, all which it may be a pretty esthetic problem to justify and sublimate. But the taste thus cultivated always craves something new and the attitude ceases soon to be one of esthetic intent and becomes instead one of low sensual desire. Contemplation is supplanted by desire, which now becomes the dominant note. Habits of passion develop and grow until both body and mind are ravaged by their deleterious effects. This is the real significance of decadence and it demonstrates, too, how works of art produced under such influences must fail in their universal import.

There is no denying that the genius in art is peculiarly exposed to these affections. The very inertia of his type of mind produces a species of hyperesthesia which, unless properly subordinated by a strong and forceful physical and mental nature, often leads to his downfall. We have so many instances where drugs, alcohol and other harmful habits have destroyed both body and mind of a bright genius, the factor is certainly one which can not be overlooked. Yet a positive element in his character may suffice to save him from this fate. So long as the individual asserts himself sufficiently to justify all his acts in the light of all his knowledge, bringing everything into connection

with everything else without losing himself in a mesh of particulars, there is not much danger of degeneracy. Even an occasional lapse may find adequate place and absolution in such a character.

But so soon as such lapses from the physical and social order become dominant notes in one's life, either as things which one constantly deplores, or as things which one vaunts and praises, then the individual is shocked and begins to lose his positive force in society.

The genius may be as healthy and normal as another man; yet many indeed there are who have produced true works of genius only to succumb afterwards before their ruling passions. As a mode of life that of the artist is hardly to be commended. It is an artifice, an excrescence. It leads to too much objectifying and too little practise. Few individuals can stand this.

On the other hand, the true artist in an ideal sense is at the same time the true man. For he should be strong both of body and of mind, with a wide experience and a deep insight, with an understanding so broad that nothing is foreign to him, yet in whom nothing dominates so as to protrude beyond its proper setting. Such a man is, indeed, inspired with intuitive insight, but he is rare, even impossible. Yet there have been those who possessed this attitude in all its completeness for a time, and while under its influence they have produced undying works. These are the men to whom we commonly attribute genius. The usual critical mistake in dealing with such personages is either to attempt to make their complete lives perfectly consistent with these higher moments, or else by pointing out their weaknesses to decry even their greatest works. Needless to say there is neither sense nor use in either method.

The strength of the genius is only the strength of the ordinary man slightly intensified; the weakness of the genius is just the weakness of the ordinary man, but more conspicuous by contrast. Psychologically it is not at all incomprehensible to conceive a man of alternate high and low moments, alternate strength and weakness. It would be well-nigh inconceivable that a man should be always the one or the other.

If consistency of character is less marked in the genius than in the ordinary man, it is this which constitutes his uniqueness among men and may even at times determine his genius. The genius is more than apt to be a poor citizen, yet we can tolerate him for his work and because his kind is exceptional and few in number. If we would understand his nature and his art we must study his life in detail, unbiased and with broad understanding, for we are dealing with one who runs the gamut of emotions in order that he may sublimate them all.

THE BIRTH OF THE IDEA OF SPIRIT IN GREEK THOUGHT

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THE ideal side of life came into Greek consciousness on the eastern shore of the blue Mediterranean, under the shadow of Mt. Ida, in sunny Ionia with its fertile plains and luxuriant verdure and its rich and brilliant cities.

The poets were its forerunners, Homer, Alkaeus, Sappho and Anakreon. First there were the wandering poets, and then a school of poetry arose in the many tinted isle of Mitylene with Sappho at its head at the end of the seventh century, a school which was compared in antiquity to the circle of Sokrates. Schools of philosophy followed in Miletos, that hot-house of intellect, and later on in Ephesos, where Sappho and Herakleitos were born. We do not know whether these schools were organized *Thiasai,* dedicated to the goddesses like the school of Pythagoras in southern Italy and the Greek schools of philosophy of a later age, but it may well have been so, for in Ionia as in Greece there was a 'shrine at every turn of the mountain path, and a religious ceremony for every act of daily life.'

On the southern shore of the Gulf of Smyrna, opposite the river Hermus, with Mitylene in the distance across the sea, was the city of Klazomenai, the modern Voorla. There Anaxagoras was born, who was the first among the Greeks to evolve the idea of spirit as a philosophical principle. Yet like all great ideas, this one, perhaps the greatest, was vague and uncertain in its first appearance. Anaxagoras belonged to the school of Anaximenes of Miletos. Miletos lay only a few miles south of Klazomenai on the shore of another picturesque gulf of the eastern Mediterranean, and from the time of Thales it had been a center of philosophic thought. Theophrastos states that Anaxagoras was an 'associate of the philosophy of Anaximenes,' but these two great thinkers were not contemporary, as Anaximenes died in 520 B.C., two decades before the birth of Anaxagoras. The connection between them lay especially in a love of scientific research, and in similar methods of explanation of astronomical and cosmological facts. Anaxagoras lived in Ionia until he was about forty years of age, and he attained great fame in his own country during the last ten years of his residence there, gaining a reputation for depth of thought and integrity of life, and slowly evolving his theory of the universe.

The Ionian philosophers were monists and materialists. They sought a fundamental substance, water, air or fire, or some other form

of matter, as the reality of life. In the language of the early Greeks we find the words soul and spirit synonymous with breath, and while the Greeks had the practical idea of the soul as the active power in being, they conceived of it as a thinner, finer form of matter. For example, Anaximenes speaks of air as being the breath of life. These old Ionian thinkers were not materialists, however, in quite the modern sense, which explains spirit as a function of matter, but they held rather the childlike idea that spirit is a purer, higher form of matter, for matter with them was the eternal existing something. It was not created, neither did the gods of Grecian mythology give it its form, for the gods had very little to do with the inner life of the Ionian thinkers in their efforts to find a natural cause for all phenomena.

Anaxagoras did not have very much difficulty in formulating a cosmic theory which suited him, that is, in making 'cosmos out of chaos.' His method of working was reasonably scientific, but the results of his theory in regard to the origin of things around him were ludicrously childish and impossible, and were not of especial service to Greek thought except as they led up to his one great idea. We will give in a few words the substance of his world theory. Herakleitos, the philosopher of the flux, had founded his cosmos upon constant change, or becoming. Anaxagoras repudiated the idea of change; absolute change was impossible. "The Hellenes," he said, "are wrong in using the expressions 'coming into being' and 'perishing,' for nothing comes into being or perishes, but there is mixture and separation of things that are." Chemical change he had never thought about; therefore, things must always have been what they are now. All objects, organic or inorganic, in which respect he made no distinction, as bone, flesh or gold, for example, had existed from eternity in the same form in small particles. The apparently simple substances, like air, fire, earth and water, are really the most complex, because they contain the greatest number of these particles. In the beginning this infinite number of small particles was in the form of chaos. In chaos a wonderfully rapid whirling motion started, and like particles joined with like until objects as we know them, including all forms of animal life, came into existence. Aristophanes, in his 'clouds,' ridicules Anaxagoras's idea of the whirl with pungent wit, for he represents one of his characters as saying that Zeus is no longer the leading god, but 'whirl' has taken his place.

Anaxagoras, however, was not as illogical in regard to the origin of motion as he had been regarding the construction of matter. He knew that motion could not start of itself. The origin of motion was the problem which his contemporaries were solving in different ways, according to their trend of thought, Empedokles with his love and hate, or primitive form of chemical affinity, and Leukippos with atoms in a vacuum, the heaviest falling faster and uniting. Neither of these

theories, however, seemed satisfactory to Anaxagoras. How then could he start the whirl in chaos? Long years of meditation were doubtless necessary before he evolved his great idea, which revealed a dim understanding of the power of reason in the origin of being. To start a whirl he must have an outside something, and if reason is the strongest element of human power, why should there not be some form of reason which is independent of matter and able to originate the whirl in chaos, and then to retire from the scene of action and return to the separate and lonely existence of its unknown past? Thus was born the idea of the Nous. The Nous is half spirit and half matter, as yet a vague force, the beginning of a conception of the thinking element in the universe. There is only one fragment preserved from the sayings of Anaxagoras which would imply a kind of personality in the Nous, in which he speaks of its having knowledge of the past, present and future. In general, however, we find that Anaxagoras's understanding of the Nous was rather that of a kind of matter, a thinking essence, the lightest of all things, a semi-material force.

When Anaxagoras was forty years old, having partially at least formulated his world theory, he went to Athens, the first philosopher to live there. Athens was then in the dawn of its brightest day. Perikles was coming into power, and his mind was seething with all the possibilities which the development of the Athenian democracy provided, and he was ripe for the strongest idealistic teaching of his age. Anaxagoras's migration to Athens has sometimes been attributed to Aspasia, who, herself from Miletos, would be desirous of bringing to Athens as much as possible of the brilliancy and culture of Ionia. There are chronological difficulties, however, against this supposition, as Aspasia must have been too young at that time to have gained influence over Athenian society; in fact, it may be quite possible, on the contrary, that Anaxagoras was himself the cause of Aspasia's going to Athens. Perikles, in his desire for the best for his beautiful Athens, very probably himself invited Anaxagoras from Ionia to Greece.

Anaxagoras's influence over Perikles was strong, and from the congenial counsels of these two great men was brought forth a wonderful atmosphere of love of freedom and reign of reason in Athens. We can picture Athens as she was in the beginning of Perikles's power from the excavations of Dr. Dörpfeld, president of the German School of Archeology in Athens, begun in 1891, on the northwest side of the Akropolis—a primitive town with small, insignificant houses and narrow streets—and it was during the three decades of Anaxagoras's life in Athens that the marvelous changes there were produced by Perikles. Eager pursuit of knowledge and art arose. Astronomy was influencing the reckoning of time. A new Athens was building with straight, broad streets and graceful columns. Music and gymnastics were being made prominent, and on the Akropolis was beginning to blossom the highest

expression of beauty ever made by the human race. In the latter part of this period books, also, were in common use, although not as yet very numerous. Peisistratos had founded a library for those who applied themselves to letters, which had passed through various vicissitudes, and the Athenians had increased it with a great deal of care. To the stock of books in existence at that time Anaxagoras made an important addition. His book did not have an original title, being called *πέρι φύσεμς*, or 'On Nature,' like many other productions of Ionian philosophers, but his ideas were original, and it was the first book to be illustrated by diagrams, with the exception of geometrical writings. In Plato's time the book was on sale for a drachma, although it is said to have consisted of several volumes. Probably the volumes may have been rather what we should call chapters. This book, alas, is no longer in existence, although we possess important fragments of it, mostly found in Simplicius's commentary on Aristotle's physics, which was written in the sixth century, at which time a copy of the book was to be had.

Let us now consider some strange phenomena in connection with the first appearance of the idea of spirit in Greek philosophy. Anaxagoras himself had the characteristics of the idealist, but his world theory and the general trend of his studies were closely allied with the teachings of his materialistic predecessors in Ionia. He could not wholly escape from his age. When Sokrates heard of Anaxagoras's book he was delighted that some one had attributed the universe to an all-pervading spirit, and immediately sent for the book; but he was greatly disappointed on reading it, as he did not find there the idealism for which he had sought. Anaxagoras belonged not to the age of Sokrates, although he was partly contemporary with him, but he belonged wholly to the Ionian school of mathematical astronomy. The thought of Anaxagoras was scientific rather than philosophic, and his book was devoted to scientific, mathematical explanations of cosmography and astronomy. The Nous was not to him the all-important part, but only a necessary cause for the beginning of motion—a secondary first cause, so to speak. Yet the idea of the Nous was sufficient to introduce rationalism into Greece, for it was the first presentation of an existing rational force wholly distinct from matter. Anaxagoras was bent upon scientific discovery, and the important things in his mind were his method and his original theory of matter. How often it happens that what seems secondary to a great man proves after all his most far-reaching service to the world. As, for example, with Plato his philosophy was secondary in his own mind to his ideas of political reform, and, while it is true that the latter have been much regarded, yet the former have revolutionized all philosophic thought. Anaxagoras's rationalism did not enable him to produce a rational theory of matter, yet it rationalized all his thought and was a stepping-

stone between the earlier study of nature and the later study of man. Indeed, his rationalism affected Greece through his followers, who were Perikles, Euripides and Thukydides. It is probable, also, that Themistokles studied with him at some period, perhaps when Anaxagoras was still in Asia Minor during the time of Themistokles's ostracism.

The introduction of the Nous into Greek thought changed the basis upon which rested the accepted opinions of the multitude. We see this first of all in the necessary metamorphosis of religious beliefs which began in the age of Perikles.

The first strong point of influence on the part of Anaxagoras in revolutionizing thought was in his astronomy, which was sufficiently developed to enable him to give a comparatively correct explanation of eclipses and other astronomical phenomena. It was a part of the creed of the age that the heavenly bodies were gods, and even in the time of Plato it was considered a crime not to believe in the godhead of the sun and moon. Anaxagoras asserted that the sun was not Helios, the god, but a mass of ignited stone as large as, or larger than, the Peloponnesus. He even tried to explain how it became ignited. He attempted to reduce all meteorological and elemental phenomena to law, and although some of the laws were wrong, yet the idea of law as a force in nature controlling phenomena was a rationalizing power that we can hardly compute, for according to the belief of the multitude, the gods interfered to produce these phenomena. Anaxagoras has left no writings, to our knowledge, directly on religion. The Nous even does not seem to have been a god, but rather a force; yet by introducing laws to control the outward phenomena of the universe, by one fell stroke he destroyed the deepest-seated religious ideas of those around him. The lightning blast that Zeus produced from Mt. Olympus by shaking his ægis, was accounted for sacrilegiously by Anaxagoras. The rain, the storm and the seasons the people regarded as the work of Zeus; and Anaxagoras in explaining them according to natural laws seemed to threaten the foundation of their religion. The world had been the plaything of the gods. It was now the work of a rational principle. Anaxagoras separated the gods from the procession of natural phenomena; but that he did not wish to destroy the reverence with which they were regarded is shown by the spirit in which the restoration and the enlargement of the Akropolis was undertaken, while his influence was still strong over Perikles.

Science, too, was changed by Anaxagoras, not only because he did much toward reducing to order and formulating the astronomical and cosmological theories of the time, but because he made law the basis of scientific research, and sought to find the uniformity of law in the phenomena of nature. He received a strong incentive to rational study of science in his young manhood when he had the opportunity of visit-

ing a large meteoric stone which fell near the Aegospotamos River, on the northern shore of the Hellespont. Who can tell what his thoughts were then, as he perceived with his own eyes the material character of this messenger from the heavenly bodies, the so-called gods?

The influence of the idea of the Nous on the political life of Athens can not be estimated. Perikles was a political idealist, bent on making the most of the intellectual ability of every Athenian citizen, and the close intimacy with a man like Anaxagoras probably accounts for much of the fineness of his work and his freedom from the superstitions of his age. The ruins of the Akropolis of Athens at the present time show us something of what his idealism did for art. Anaxagoras taught that the Nous exists in all things in a greater or less degree, and the art of his age, the highest that the world has known, expresses to a degree never before attained the psychical basis of beauty.

Anaxagoras's service to philosophy was, however, the greatest, although it has not been fully appreciated. For the first time the psychical element entered into philosophic research. The Nous had to be reckoned with, as well as matter so-called, and since then we have had different grades of world theories, some of which attribute to the psychical the whole of reality, like that of Plato, some the part, as with Aristotle, and some none at all, as with the materialists. With Anaxagoras was born the idea of spirit, yet in the vague and glimmering way in which all ideas come into existence, and the gratitude of the world for this idea has been given to Sokrates and Plato, who presented it in its fulness. Anaxagoras, therefore, does not rank as great among philosophers in popular opinion, because he was so soon overshadowed by those who completed his conception of the spiritual.

When Perikles's power began to wane and he could no longer protect his friend and teacher, the vengeance of the multitude whose gods had been attacked fell upon Anaxagoras. He was cast into prison, and saved with difficulty by his pupil, and exiled to Lampsacus, on the southern shore of the Hellespont. There he organized a school of philosophy, and the Anaxagoreans are referred to occasionally by later Greek philosophers, but the school was soon overshadowed by the results of the age immediately succeeding. When Anaxagoras was ill and likely to die, his friends in Lampsacus asked him what they could do in his memory, and he replied that he would be pleased to have the anniversary of his death kept as a holiday, and this custom was long observed. The people of Lampsacus also honored Anaxagoras after his death by erecting an altar to him, bearing on one side the word 'Nous' and on the other the word 'Truth.'

The greatest tribute, however, to Anaxagoras was paid in the time of imperial Rome, a tribute of which he was not unworthy. An imperial Roman coin was issued at Klazomenai, on the reverse of which was the philosopher Anaxagoras with the globe in his hand.

SCIENTIFIC ASPECTS OF LUTHER BURBANK'S WORK

By VERNON L. KELLOGG

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MR. BURBANK has so far not formulated any new or additional laws of species-change, nor do his observations and results justify any such formulation, and we may rest in the belief that he has no new fundamental laws to reveal. He has indeed the right to formulate, if he cares to, some valuable and significant special conclusions touching certain already recognized evolution factors, in particular, the influence on variability of the two long-known variation-producing factors of hybridization and modification of environment. His reliance on the marked increase in variability to be got after a crossing in the second and third generations over that obvious in the first will come as a surprise to most men first getting acquainted with his work. He has got more starts for his new things from these generations than in any other way. He is wholly clear and convinced in his own mind as to the inheritance of acquired characters; 'acquired characters are inherited or I know nothing of plant life,' he says; and also convinced that the only unit in organic nature is the individual, not the species; that the so-called species are wholly mutable and dependent for their apparent fixity solely on the length of time through which their so-called phyletic characters have been ontogenetically repeated. He does not agree at all with de Vries that mutations in plants occur only at certain periodic times in the history of the species, but rather that, if they occur at all, they do so whenever the special stimulus derived from unusual nutrition or general environment can be brought to bear on them. He finds in his breeding work no prepotency of either sex as such in inheritance, though any character or group of characters may be prepotent in either sex. He believes that no sharp line can be drawn between the fluctuating or so-called Darwinian variations and those less usual, large, discontinuous ones called sports. Ordinary fluctuating variation goes on under ordinary conditions of nutrition, but with extraordinary environmental conditions come about extraordinary variation results, namely, discontinuous, sport or mutational variation. These variations are the effects of past environment also, having remained latent until opportunity for their development occurs. Starvation causes reversions, but reversions can also be produced by unusually rich nutrition. New variations are developed most often, as far as environmental influences go, by rich soil

and generally favorable conditions. So-called *new* qualities are usually, if not always (the fact may sometimes not be obvious), simply new combinations of old qualities, both latent and obvious. To get a new and pleasing odor it may often be sufficient simply to lose one bad element in an old odor. So one might go on for some pages with specific conclusions or deductions reached by Burbank on a basis of experience. But it is true that he has at his command the knowledge of no new fundamental scientific principles to give him advantage over us. And yet none of us has done what Burbank has been able to do, although many of us have tried. What then is it that Burbank brings to his work of modifying organisms swiftly and extremely and definitely that others do not?

To answer this it will be advisable to analyze, in general terms, at least, the various processes which either singly, or in combinations of two or three, or all together, are used by Mr. Burbank in his work. We may roughly classify these processes and means. First, there is the importation from foreign countries, through many correspondents, of a host of various kinds of plants, some of economic value in their native land and some not, any of which grown under different conditions here may prove specially vigorous or prolific or hardy, or show other desirable changes or new qualities. Among these importations are often special kinds particularly sought for by Burbank to use in his multiple hybridizations; kinds closely related to our native or to already cultivated races which, despite many worthless characteristics, may possess one or more particular, valuable ones needed to be added to a race already useful to make it more useful. Such an addition makes a new race.

Second, the production of variations, abundant and extreme, by various methods, as (*a*) the growing under new and, usually, more favorable environment (food supply, water, temperature, light, space, etc.) of various wild or cultivated forms, and (*b*) by hybridizations between forms closely related, less closely related and, finally, as dissimilar as may be (not producing sterility), this hybridizing being often immensely complicated by multiplying crosses, *i. e.*, the offspring from one cross being immediately crossed with a third form, and the offspring of this with still another form, and so on. These hybridizations are made sometimes with very little reference to the actual useful or non-useful characteristics of the crossed parents, with the primary intention of producing an unsettling or instability in the heredity, of causing, as Burbank sometimes says, 'perturbations' in the plants, so as to get just as wide and as large variation as possible. Other crosses are made, of course, in the deliberate attempt to blend, to mix, to add together, two desirable characteristics, each possessed by

only one of the crossed forms. Some crosses are made in the attempt to extinguish an undesirable characteristic.

Third, there is always immediately following the unusual production of variations, the recognition of desirable modifications and the intelligent and effective selection of them, *i. e.*, the saving of those plants to produce seed or cuttings which show the desirable variations and the discarding of all the others. In Burbank's gardens the few tenderly cared for little potted plants or carefully grafted seedlings represent the surviving fittest, and the great bonfires of scores of thousands of uprooted others, the unfit, in this close mimicry of Darwin and Spencer's struggle and survival in nature.

It is precisely in this double process of the recognition and selection of desirable variations that Burbank's genius comes into particular play. Right here he brings something to bear on his work that few other men have been able to do. It is the extraordinary keenness of perception, the delicacy of recognition of desirable variations in their (usually) small and to most men imperceptible beginnings. Is it a fragrance that is sought? To Burbank in a bed of hundreds of seedling walnuts scores of the odors of the plant kingdom are arising and mingling from the fresh green leaves, but each, mind you, from a certain single seedling or perhaps from a similar pair or trio. But to me or to you, until the master prover points out two or three of the more dominant single odors, the impression on the olfactories is simply (or confusedly) that of one soft elusive fragrance of fresh green leaves. Similarly Burbank is a master at seeing, and a master at feeling. And besides he has his own unique knowledge of correlations. Does this plum seedling with its score of leaves on its thin stem have those leaves infinitesimally plumper, smoother or stronger, or with more even margins and stronger petiole or what not else, than any other among a thousand similar childish trees? Then it is saved, for it will bear a larger, or a sweeter, or a firmer sort of plum, or more plums than the others. So to the bonfires with the others and to the company of the elect with this 'fittest' one. Now this recognition, this knowledge of correlations in plant structure, born of the exercise of a genius for perceiving through thirty years of opportunity for testing and perfecting it, is perhaps the most important single thing which Burbank brings to his work that other men do not (at least in such unusual degree of reliability). Enormous industry, utter concentration and single-mindedness, deftness in manipulation, fertility in practical resource, has Burbank—and so have numerous other breeders and experimenters. But in his perception of variability in its forming, his recognition of its possibilities of outcome, and in his scientific knowledge of correlations, a knowledge that is real, for it is one that is relied on and built on, and is at the very foundation of his

success, Burbank has an advantage of true scientific character over his fellow workers, and in it he makes a genuine contribution to scientific knowledge of plant biology, albeit this knowledge is so far only proved to be attainable and to exist. It is not yet exposed in its details and may never be, however unselfish be the owner of it. For the going to oblivion of scientific data of an extent and value equivalent, I may estimate roughly, to those now issuing from any half dozen experimental laboratories of variation and heredity, is the crying regret of all evolution students acquainted with the situation. The recently assumed relations of Mr. Burbank to the Carnegie Institution are our present chief hope for at least a lessening of this loss.

But let us follow our saved plum seedling. Have we now to wait the six or seven years before a plum tree comes into bearing to know by actual seeing and testing what new sort of plum we have? No; and here again is one of Burbank's contributions (not wholly original to be sure, but original in the extent and perfection of its development) to the scientific aspects of plant-breeding. This saved seedling and other similar saved ones (for from the examination of 20,000 seedlings, say, Burbank will find a few tens or even scores in which he has faith of reward) will be taken from their plots and grafted on to the sturdy branches of some full-grown vigorous plum tree, so that in the next season or second next our seedling stem will bear its flowers and fruits. Here are years saved. Twenty, forty, sixty, different seedlings grafted on to one strong tree (in a particular instance Burbank had 600 plum grafts on a single tree!); and each seedling-stem certain to bear its own kind of leaf and flower and fruit. For we have long known that the scion is not materially influenced by the stock nor the stock by the scion; that is not modified radically, although grafting sometimes increases or otherwise modifies the vigor of growth and the extent of the root system of the stock.

If now the fruit from our variant seedling is sufficiently desirable; if it produces earlier or later, sweeter or larger, firmer or more abundant, plums, we have a new race of plums, a 'new creation' to go into that thin catalogue of results. For by simply subdividing the wood of the new branch, *i. e.*, making new grafts from it, the new plum can be perpetuated and increased at will. Simple, is it not? No, it is anything but that in the reality of doing it; but in the scientific aspects of it, easily understandable.

Perhaps it may not be amiss to call attention to what must be the familiar knowledge of most of us, and that is the fact that many (probably most) cultivated plants must be reproduced by division, that is by cuttings, buds or grafts, and not by seeds, in order to grow 'true.' For a piece of a cultivated plant will grow out to be very much like the individual it was cut from, but the seeds will not, in most

cases, reproduce faithfully the parents, but will produce a very variable lot of individuals, most of them strongly reversionary in character. Grow peach trees from the stones of your favorite peach and see what manner of peaches you get; but if you want to be sure of more peaches like the ones you enjoy, graft scions from your tree on to other trees. Indeed one of the plant-breeder's favorite methods of making a start for new things, of getting the requisite beginning wealth and eccentricity of variation, is to grow seedlings, especially from cross-bred varieties. Burbank will give you a thousand dollars for a pinch of horse-radish seed. Sugar-cane seed is needed. The amelioration of many kinds of fruit and flowers and vegetables is checked, because in our carelessness we have allowed these kinds to get into that condition of seedlessness which almost all cultivated races tend toward when grown from cuttings. In our oranges and grape-fruit and in a score of other fruits, the elimination of seeds is exactly one of the modifications we have bred and selected for, in order to make the fruits less troublesome in their eating. But when we lose the seeds entirely of a whole group of related plant kinds we may find ourselves, as we have found ourselves actually in many cases, at the end of our powers of amelioration of these plant sorts. Burbank believes that the very fact that plants when grown asexually always sooner or later lose their power to produce seeds is almost sufficient proof (if such proof is needed) that acquired characters are transmitted.

Another of Burbank's open secrets of success is the great range of his experimentation—nothing is too bold for him to attempt, the chances of failure are never too great to frighten him. And another secret is the great extent, as regards material used, of each experiment. His beds of seedlings contain hundreds, often thousands, of individuals where other men are content with hundreds. Another element in his work is his prodigality of time. Experiments begun twenty years ago are actually still under way.

In all that I have so far written, I have purposely kept to general statements applicable to Burbank's work as a whole. My readers might be more interested, perhaps, to have some illustrations of the application of various processes of making new sorts of things, some analytical account of the history of various specific 'new creations,' but considerations of space practically forbid this. Just a few briefly described examples must suffice. More than is generally imagined, perhaps, Burbank uses pure selection to get new things. From the famous golden orange colored California poppy (*Escholtzia*) he has produced a fixed new crimson form by selection alone. That is, noticing, somewhere, sometime, an Escholtzia individual varying slightly redder, he promptly took possession of it, raised young poppies from its seeds,

selected from among them those varying in a similar direction, raised new generations from them and so on until now he who wishes may have his California poppies of a strange glowing crimson for the price of a little package of seed, where formerly he was perforce content with the golden orange. For me the golden orange suffices, but that does not detract from my eager interest in the flower-painting methods of Mr. Burbank. Even more striking a result is his blue Shirley poppy, produced also solely by repeated selection from the crimson field poppy of Europe. "We have long had various shades of black and crimson and white poppies, but no shade of blue. Out of 200,000 seedlings I found one showing a faintest trace of sky blue and planted the seed from it, and got next year one pretty blue one out of many thousand, and now I have one almost pure blue."

But another brilliant new poppy was made in a different way. The pollen of *Papaver pilosum,* a butter-colored poppy, was put on the pistils of the Bride, a common pure white variety of *Papaver somniferum* (double), and in the progeny of this cross was got a *fire-colored single* form. The character of singleness was common to the ancestors of both parents, the character of fire color in the lineage of *somniferum* only, although the red of the new form is brighter than ever before known in the somnifera series. Both characteristics were absent (or rather latent) in both parents. And yet the perturbing influence of the hybridization brought to the fore again these ancestral characters. The foliage of this fire poppy is intermediate in type between that of the two parents.

The history of the stoneless and seedless plum, now being slowly developed by Burbank, shows an interesting combination of selection, hybridization and reselecting. Mr. Burbank found a plum in a small wild plum species with only a part of a stone. He crossed this wild species with the French prune; in the first generation he got most individuals with whole stones, some with parts of a stone, and even some with no stone. Through three generations he has now carried his line by steadily selecting, and the percentage of no-stone fruits is slowly increasing, while quality, beauty and productiveness are also increasing at the same time.

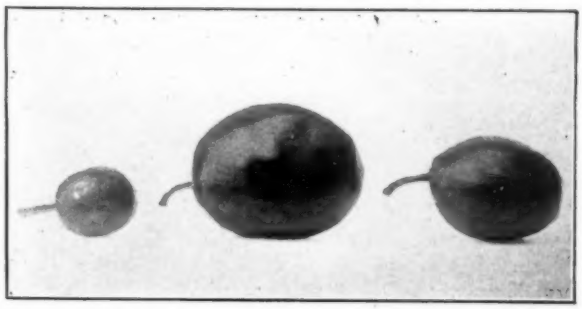
The plum-cot is the result of crossing the Japanese plum and the apricot. The plum-cot, however, has not yet become a fixed variety and may never be, as it tends to revert to the plum and apricot about equally, although with also a tendency to remain fixed, which tendency may be made permanent.

Most of Burbank's plums and prunes are the result of multiple crossings in which the Japanese plums have played an important part. Hundreds of thousands of seedlings have been grown and carefully worked over in the twenty years of experimenting with plums, and single trees

CALIFORNIA POPPY (*Escholtzia*) rendered bright crimson as a result of selection only, without crossing.

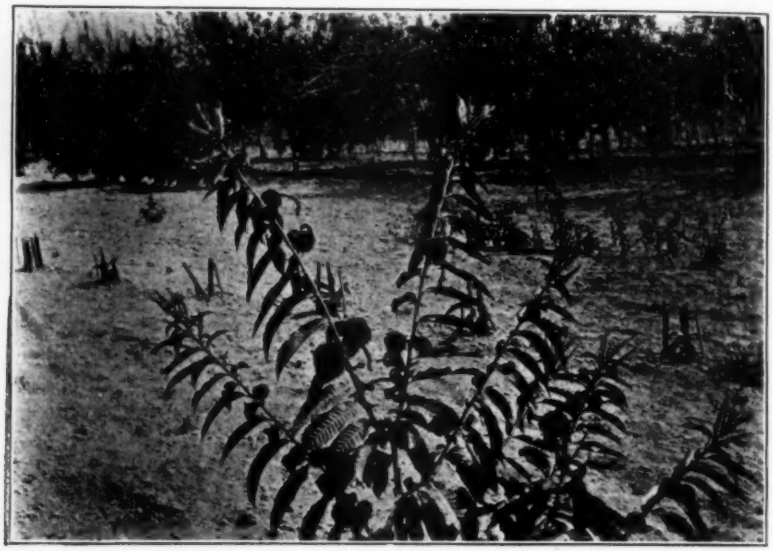
have been made to carry as many as 600 varying seedling grafts. The Bartlett plum, cross of the bitter Chinese Simoni and the Delaware, itself a Simoni hybrid, has the exact fragrance and flavor of the Bartlett pear. The Climax, a successful shipping plum, is also a cross of the Simoni and the Japanese triflora. This Chinese Simoni produces almost no pollen, but few grains of it ever having been obtained. But these few grains have enabled Burbank to revolutionize the whole plum shipping industry. The sugar prune, which promises to supplant the French prune in California, is a selected product of a second or third generation variety of the Petite d'Agen, a somewhat variable French plum.

Next in extent probably to Burbank's work with plums and prunes



ONE OF THE STONELESS PLUMS (CENTER) AND TWO OF ITS PARENTS. On the right hand the common French prune.

is his long and successful experimentation with berries. This has extended through twenty-five years of constant attention, has involved the use, in hybridizations, of forty different species of *Rubus,* and has resulted in the origination of a score of new commercial varieties, mostly obtained through various hybridizations of dewberries, blackberries and raspberries. Among these may specially be mentioned the Primus, a hybrid of the western dewberry (*R. ursinus*) and the Siberian raspberry (*R. cratægifolius*), fixed in the first generation, which ripens its main crop before most of the standard varieties of raspberries and blackberries commence to bloom. (Mr. Burbank does not recommend this for general cultivation; the 'Phenomenal' and Himalaya are

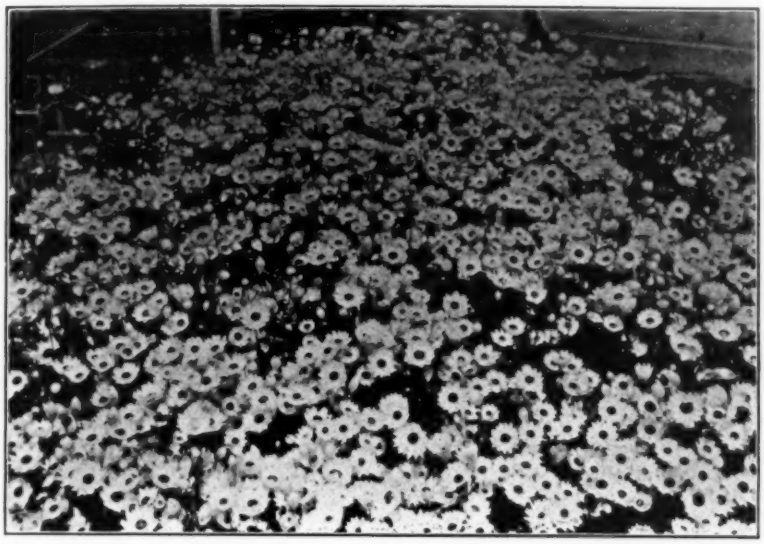


EARLY AND ABUNDANT BEARING CHESTNUT TREE. One of hundreds of similar ones, due to crossing and selection. These bear fruit at the age of one and a half years and are never without fruit.

better.) In this Primus berry, we have the exceptional instance of a strong variation, due to hybridization, breeding true from the time of its first appearance. It usually takes about six generations to fix a new variety, but like de Vries's evening primrose mutations, the Primus berry is a fixed new form from the time of its beginning. An interesting feature of Mr. Burbank's brief account, in his 'New Creations' catalogue of 1894, of the berry experimentation, is a reproduction of a photograph showing "a sample pile of brush 12 ft. wide, 14 ft. high, and 22 ft. long, containing 65,000 two- and three-year-old seedling berry bushes (40,000 blackberry × raspberry hybrids and 25,000 Shaffer × Gregg hybrids) all dug up with their crop of ripening berries." The

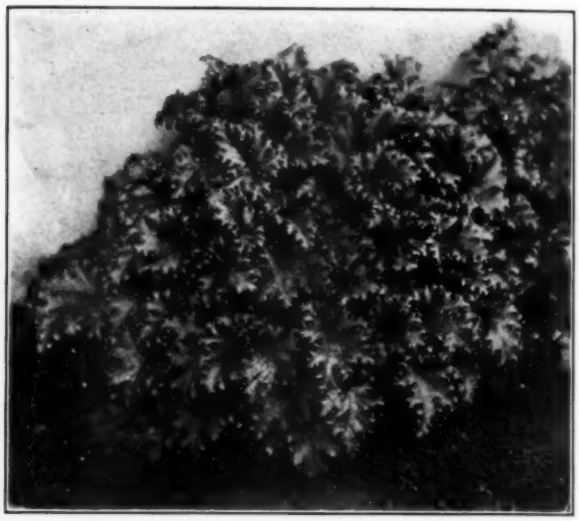
photograph is introduced to give the reader some idea of the work necessary to produce a satisfactory new race of berries. "Of the 40,000 blackberry × raspberry hybrids of this kind 'Phenomenal' is the only one now in existence. From the other 25,000 hybrids, two dozen bushes were reserved for further trial."

An astonishing result of the hybridization between the black walnut, *Juglans nigra,* used as the pistillate parent, and the California walnut, *J. californica,* staminate parent, are walnut trees which grow with such an amazing vigor and rapidity that they increase in size at least twice as fast as the combined growth of both parents. Many tremendous growers are got in the first generation, but in the second there are included some of the most rapidly growing trees, perhaps, in the world. This hybrid has clean-cut, glossy bright green leaves from two to three feet long with a sweet odor like that of apples, but it produces few nuts. Curiously enough the result of hybridization by using the pollen of *nigra* on pistils of *californica* produces in abundance large nuts of a quality superior to that possessed by either parent.



***Rhodanthe naglesi*, improved in size and color by selection only.**

The famous Shasta daisy is the result of a multiple crossing between an American and a European species of field daisy and then between these hybrids and a Japanese form. The fragrant calla, known as 'Fragrance,' is descended from a single individual found by Burbank while critically examining a block of Little Gem calla seedlings. He was surprised in this examination by a fragrance resembling that of violets or water-lilies; as he had long been seeking a fragrant calla,



Heuchera LEAVES MADE CRESTED BY SELECTION OF VARYING SEEDLINGS.

the individual giving this perfume was carefully hunted out. No farther selecting was done; this plant was the single ancestor of the fragrant new race.

And so one might go on for pages, but with slight variations in detail all these pages would tell only the same story: the stimulating or inducing of variability by environmental influences and by hybridizations; the search after, and keen recognition of, promising special variations; the selection of the plants showing these variations; rearing new generations from them, repeated selection, and new hybridizations to eliminate this characteristic or introduce that, and on until a desirable combination is found. Then the careful fixing of this form or type by repeated selection through several generations.

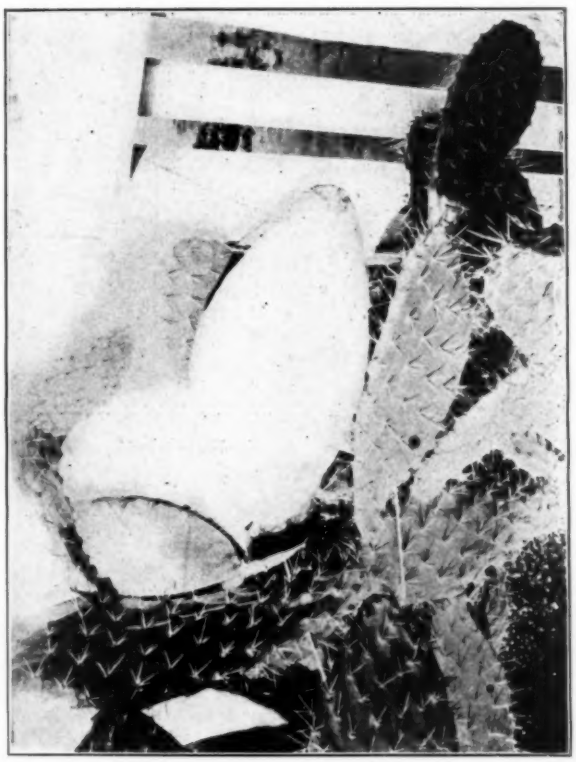
But an end must be made of this. Let us, in a paragraph, simply sum up the essential things in the scientific aspects of Burbank's work. No new revelations to science of an overturning character; but the revelation of the possibilities of accomplishment, based on general principles already known, by an unusual man. No new *laws* of evolution, but new facts, new data, new canons for special cases. No new principle or process to substitute for selection, but a new proof of the possibilities of the effectiveness of the old principle. No new categories of variations, but an illuminating demonstration of the possibilities of stimulating variability and of the reality of this general variability as the fundamental transforming factor. No new evidence either to help the Darwinian factors to their death-bed, or to strengthen their lease on life; for the 'man' factor in all the selecting phenomena in Burbank's gardens excludes all 'natural' factors. Here are some of

Burbank's own words, touching these matters that scientific men are particularly interested in, in his work:

All scientists have found that preconceived notions, dogmas, and all personal prejudice must be set aside, listening patiently, quietly and reverently to the lessons one by one which mother nature has to teach, shedding light on that which before was a mystery, so that all who will may see and know.

Crossing gives the raiser of new plants the only means of uniting the best qualities of each, but just as often the worst qualities of each are combined and transmitted, so that to be of any value it must be followed by rigid and persistent selection, and in crossing, as in budding and grafting, the affinities can only be demonstrated by actual test.

All wild plants of any species are under almost identical environments, having their energies taxed to the utmost in the fierce struggle for existence. Any great variation under such circumstances is not likely to occur, and is much more likely to be stamped out at once by its struggling competitors, unless the variation should be of special use in competition, in which case it will survive, and all others may be supplanted by it. Thus we see how new species are often produced by nature, but this is not her only mode. Crosses and hybrids are very often found growing wild where two somewhat similar species grow contiguous, and if the combination happens to be a useful one,



HYBRID OPUNTIA, WITHOUT THORNS OR BRISTLES, with a parent from which these appendages are to be removed by crossing and selection.

as it often does, the new creation is encouraged by nature; then time and environment fix it, and man comes on the scene, perhaps ages later, and discovers it, and, not knowing all the facts, wonders where the connecting links have gone. It is botanically classified as a new species, which it is most certainly.

In cultivated plants the life struggle is removed, and here we find variation almost the rule rather than the exception.

Varieties are the product of fixed laws, never of chance, and with a knowledge of these laws we can improve the products of nature, by employing nature's forces, in ameliorating old or producing new species and varieties better adapted to our necessities and tastes. Better food, more sunshine, less arduous competition, will of themselves induce variation in individual plants which will be more or less transmitted to their seedlings, which, selected consecutively through a certain number of generations, will become permanent. Environment here exerts an influence as in all chemical cosmical and celestial movements. These small increments from environmental forces may produce a gradual or sudden change according to circumstances. The combustion of food liberates the moving force, environment guides it as it does the planets.

When once the persistent type is broken up, old latent forces may be liberated and types buried in the dim past reappear. This, called atavism, is a concentration of ancestral forces—reverberating echoes—from varieties long since passed away, exhibiting themselves when from some cause, for instance crossing, present forces are in a state of antagonism, division, perturbation or weakness. These echoes, if collected by crossing and selection, produce combinations of superlative importance and value.

Finally, in any summation of the scientific aspects of Burbank's work must be mentioned the hosts of immensely valuable data regarding the inheritance of characteristics, the influence of epigenetic factors in development, the possibilities of plant variability, and what not else important to evolution students, mostly going unrecorded, except as they are added in mass to the already too heavy burden carried by the master of the laboratory, and as they are summed up in those actual results which the world gratefully knows as Burbank's 'new creations.'

DISCUSSION AND CORRESPONDENCE

THE EFFECTS OF IMMIGRATION ON HOMICIDE

UNDER this heading, Mr. Maynard Shipley has presented extensive statistical material, in the August number of THE POPULAR SCIENCE MONTHLY, to prove the undesirable character of immigrants from eastern and southern Europe, as compared with those from its northern and western countries and, by inference, with native-born Americans. While I do not wish to impugn the good faith of his investigations, he manipulates the figures which he quotes in so remarkable a manner as to justify the belief that he has approached his subject with preconceived notions, which have blinded him to some of the pitfalls in so serious an inquiry. I do not wish to whitewash the immigrants, but merely to point out Mr. Shipley's errors, hoping earnestly that more careful methods may prevail in the study of large masses of our present population, if it is to guide our legislators in the adoption of a policy toward immigration. If the foreigner is to be kept out, let it be done frankly on the score of racial prejudice, but do not seek to blacken his character by the use of ill-digested statistics.

The gravest defect in Mr. Shipley's presentation is the continuous shifting of basis, without attempting to make corresponding corrections. Sometimes figures are given for homicide as a total; at others we have the division into murder and manslaughter. Presently, I shall show why manslaughter must necessarily be on the increase in American court records; hence statistics which do not distinguish it from intentional homicide are valueless as showing a criminal tendency of the population. All Mr. Shipley's comparisons that tell most severely against the recent immigrant fail to make the distinction. Manslaughter is practically the unintentional killing of a human being by another, and it is the charge upon which a man would be held, whose careless handling of machinery caused death; the introduction of cable-cars and trolleys enormously increased the number of fatal street accidents; as have the erection of steel-framed buildings, with the coincident abandonment of fixed scaffolding, the use of power-hoists, the employment of dynamite in excavating, enhanced the dangers of building operations. Did he take these developments into account? Did he realize that the man arrested for such an 'accident' was, nine times out of ten, an 'ignorant foreigner,' whom the greed of a native-born American entrusted with dangerous implements, without providing him with adequate safeguards in their use?

Again, in Table II., homicide is studied according to the nationality of the people *killed* in San Francisco, with the intention of proving the criminality of the Chinese by their relatively large mortality by violence. I admit the truth of the argument that the murderer and his victim are apt to belong to the same race; in fact a sardonic member of the Immigration Restriction League might classify such homicidal tendency among the 'undesirables' as a redeeming virtue. But, for rigid statistical purposes, Mr. Shipley has overshot the mark. His own figures show that 65 out of 100,000 Chinamen in the United States were accused of murder in the year when 75 per 100,000 were being killed; are

these extra ten due to suicide or to Caucasian markmanship?

Very serious, too, is the mistake of studying *arrests for homicide*, without taking into account the relative efficiency of the local authorities. Mr. Shipley's failure to realize this is shown, not only by his indiscriminate grouping of cities in all parts of the country, but specifically by his discussion of homicide in Colorado. He compares the small number of *arrests* for this offense in Denver with the large number of *murders* in the state, properly enough emphasizing the lawless condition of the mining-camps; but he fails to ask how many Denver murderers elude a comparatively small police force, and escape into the wilderness on the many railroads radiating from the city. The question of relative police efficiency might have been studied from his Table I., giving the number of arrests for homicide in various cities. The population of New York can not be much worse than that of neighboring cities, with their factories, docks and tramp-infested freight-yards. Yet New York reports 13.23 homicide arrests per 100,000, against 9.16 in Newark and only 4.51 in 'anarchist' Paterson, Jersey City and Hoboken also reporting low figures.

Again, the attitude of the community ought to be considered, if *arrests* for homicide are made the criterion for this form of crime. Is it conceivable that the word 'lynching' should be absent from an inquiry into American murders? Not once does Mr. Shipley allude to the hundreds, nay thousands, who have participated in the lynching of negroes, of horse-thieves and 'rustlers'; were the members of these mobs enumerated, or even the crimes counted singly, how would our statistics look?

Let us now examine his study of the relation of the immigrant to homicide. First comes a diagram, Fig. 1, 'showing changing character of immigration into the United States' by three curves, showing the *percentage* of each year's total immigration, derived from northwestern Europe, southeastern Europe and 'all others.' Below is a homicide curve, which is strikingly parallel to the southeastern Europe curve. But had these curves been drawn to represent the actual numbers of each group of nationalities, instead of their percentage out of a variable whole, the parallelism would have vanished. Furthermore, the southeastern curve represents natives of Italy, Russia, Poland and Austro-Hungary, whereof the Italians form about one third. Another table, Fig. 3, gives the ratio of murderers among 1,000,000 Italians as 50.2; but that of the Poles and Magyars is shown at very much less than the French, and the large masses of Russian and Galician Jews are bunched with unclassified nationalities in a group rated at a trifle over 1 per 100,000. The peoples representing two thirds of that incriminating curve actually produced less than the average number of murderers. Bearing in mind that the criminal tendency of an immigrant could not exhaust itself in the first year after his arrival, it is evident that the homicide curve, if strongly influenced by the immigration of the last fifteen years, the period in which the Russian and Italian immigration has outnumbered the Germanic, ought to have run steeply upward, in a hyperboloid form, instead of remaining almost horizontal, and showing less of an upward tendency than during the preceding decade.

Further to incriminate the Italians, Fig. 5 arranges the states and territories in the order of homicidal statistics, and gives a graphic representation of the number of natives of northern Europe, as contrasted with a combined group of Italians, Mexicans and Chinese, living in each; the southwestern and Rocky Mountain states show the greatest mortality by violence, and by combining these three, otherwise unrelated, nationalities, their

numbers are made to appear large as compared with Teutonic immigrants. In all fairness, it ought to be open to question whether the 'Mexicans' enumerated in the census are immigrants, as Mr. Shipley assumes, or Spanish-speaking residents of what was originally Mexican territory, so largely Indian that they could hardly be classified with the Italians, even on account of their 'Latin' blood. But, as for the Italians, the states containing the great bulk of that nationality have the cleanest records, if we except Louisiana and Texas, where the high murder rate is ascribed to the negroes by Mr. Shipley himself. In fact, only one inference could be properly drawn from his Fig. 5—that the racial composition of a state's population has no influence at all, as compared with the general conditions governing the life of its citizens.

As to the influence of these general conditions upon homicide, he merely discusses the relative density of population and the criminal tendency of mining as compared with manufacturing pursuits. Having gone so far, he might naturally be expected to proceed to inquire into the brutalizing effect of certain special trades, such as slaughtering—the periodical debauches of sailors in seaports—reckless disregard for the value of human life engendered by the pursuit of hazardous callings. He should have realized that adult males are far more prone to acts of violence than either women or children, and that ratios of homicide to nationality mean nothing, unless this factor be taken into account. Immigration from northern Europe brings in more females than does that from the south and east; the Chinese, according to the census of 1900, were represented by 81,534 persons, of whom 77,936, or 95.59 per cent. were males over 21. At the same time, the native population contained only 25.55 per cent. of males over 20. I have already shown that Mr. Shipley's figures for homicide are valueless, because they do not differentiate between murder and accident; but, since he has chosen to calculate the ratio per hundred thousand foreign born of each nationality, the following table corrects these ratios so as to apply to foreign-born *adult males*, by dividing them by the corresponding percentage, as calculated from Table 12, of the Twelfth Census, Volume II.

TABLE I.

Showing: I., Number homicides per 100,000 according to Shipley; II., percentage of males over 19 years, according to Census; III., number of homicides per 100,000 adult males.

Nationality.	I.	II.	III.
Irish	1	44.67 %	2.25
German	3	43.83	6.85
English	4	49.62	7.95
Poles	6.5	49.92	13
Magyar	16	50	32
French	27	52.80	51.05
Italian	50	52.29	89.13
Chinese	63.5	95.58	66.68
Mexican	119	43.52	273.5
Entire United States	10	28.78	34.38

The homicides for the entire United States are taken from Mr. Shipley's Fig. 1, for the census year, the percentage of adult males is based on the ages given in that census and the limit of 19 years was chosen, because that was the nearest approach to 18 possible under census conditions. The significance of the correction will be

seen by comparing the Italian figures with those of the entire population. Mr. Shipley would make them five times as homicidal as the average, while the ratio in the third column is as three to seven.

Mr. Shipley perhaps realized this disturbing factor, though he does not mention it; for he goes out of his way to impugn the character of the immigrants' children, by quoting statistics according to which more than half the children brought before the New York City Children's Court are of Russian or Italian parentage. As homicide is expressly excluded from the jurisdiction of that court, the use of these statistics might seem irrelevant; but since the prejudice created might have some indirect influence upon the reader's judgment, I present an analysis of the report of that court for 1905, which is fuller than the earlier ones and in many ways might be more disadvantageous to the immigrant. In this analysis, the most serious interpretation has been given in doubtful cases, and yet it will be seen that the great majority of arrests are for trivial offenses, such as selling papers without a badge, breaking flowers in the parks, throwing stones in the street, etc., incidental rather to unguarded childhood than to viciousness. Over one quarter of the arrests have nothing to do with the child's character, as they are for improper guardianship or violation of the child labor law—further comment seems superfluous.

Finally, Mr. Shipley is not happy in his discussion of the conditions in individual cities; to follow him from town to town, however, would be tedious and would frequently result in a mere repetition of strictures already made upon his general inferences. We can take his comparison of Cleveland and Cincinnati, upon which he lays great stress, as an illuminative example. It appears that these two Ohio cities, of nearly equal size, present diverse conditions of nationality, Cleveland containing 46.1 per cent of foreign-born, among whom more than one third come from southern and eastern Europe, while Cincinnati has only 17.8 per cent. foreign-born inhabitants, something more than one tenth of whom come from southeastern Europe. "In Cleveland, the average of arrests for

TABLE II.

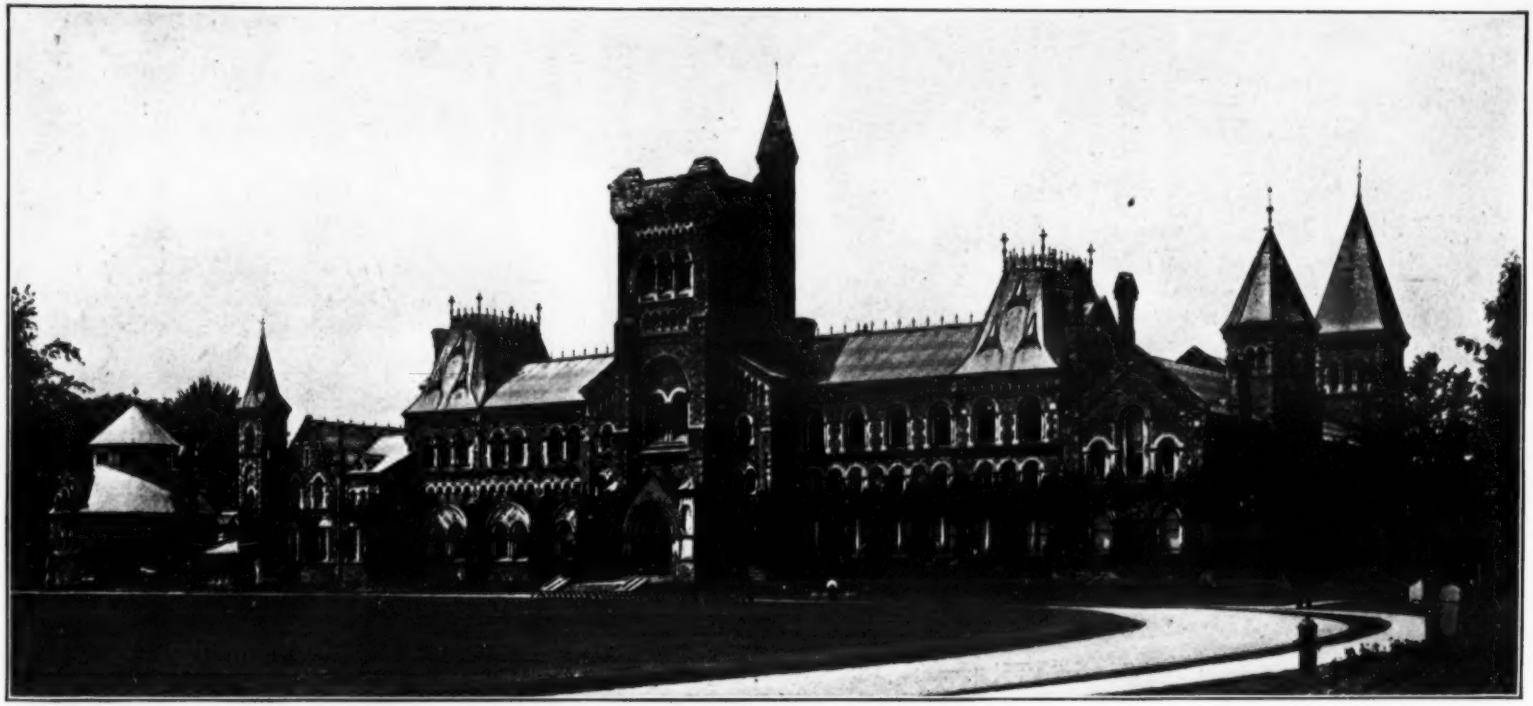
Classification of the arraignments before the Children's Court, New York City, in 1905, according to the gravity of the charges and the nationality of the children. The report furnishes no data of the nativity of the parents of children born here, but it is evident that the parents of American-born children must have been in this country at least ten years where offenses of a heinous character are involved.

	Birthplace.				Discharged.
	United States.	North-western Europe.	South-eastern Europe.	Other Countries.	
Crimes against person or property					
Felonies	809	18	133	4	419
Misdemeanors	1,175	16	211	11	580
Prostitution, etc.	94	4	26	—	25
Petty offenses of all kinds	3,177	38	339	9	767
Truancy from school	48	--	2	—	12
Disorderly and ungovernable child	563	12	104	12	182
Insanity, attempted suicide	1	—	2	—	3
Improper guardianship	1,870	16	212	25	867
Child labor law violation	427	3	54	3	19
	8,164	107	1,083	64	2,874

homicide during the two years 1903–4 was 9.56 per 100,000 of population. In Cincinnati, the average for the six years 1898–1904 was 6.23. In 1890 the disparity was still greater, the ratio being 4.04 in Cincinnati and 13.01 in Cleveland." This higher rate is ascribed at length to the influx of foreigners into Cleveland, in spite of the contrary view of the chief-of-police, from whose report the figures are derived. But is it not true that in a decade this crime has *increased* 50 per cent. in Cincinnati and *decreased* over 25 per cent. in Cleveland, in spite of the latter's growth in 'undesirable' population? Still, the foreigners in Cincinnati are not bad enough for Mr. Shipley's purpose; he therefore records that the 18.61 per cent. of foreigners in its white population allowed by the Twelfth Census furnished 64.04 per cent. of the 7,135 whites arrested in 1904; he then enumerates the arrests for murder and attempted murder and calmly asserts that 'a large proportion of these crimes were undoubtedly committed by foreign-born whites,' although the figures at his command do not seem to even admit of the usual separation of whites and negroes. Anybody ignorant of the fact that 'arrests' are made for misdemeanors as well as felonies might infer a connection between the percentages quoted above and the tendency toward homicide, which Mr. Shipley would doubtless be the first to deny; nevertheless, such careless juxtaposition must seriously inpugn the authority of an investigator.

Murder is the most atrocious crime in our penal code; before we throw the suspicion of homicidal proclivities upon hundreds of thousands of innocent immigrants, let us weigh our evidence seriously and see whether our own statistics are truthful. Is wilful homicide reported and punished uniformly throughout the country? Do our courts deal equally with the foreigner and the native, the Caucasian and the Mongolian, the rich and the poor? Is a classification into nationalities sufficient, or must age and sex also be taken into account? Are certain occupations, leading to violent habits, chosen by the immigrant from inclination or forced upon him by our social and economic conditions? Is the Italian, the Russian or the 'Hun' less amenable to law than were the founders of the Texan Republic, the 'forty-niners,' the 'Filibusters,' the 'cowboys' and the 'rustlers'? Above all, is Mr. Shipley right in asserting, on page 168 of his article, that the second generation of foreigners is always worse than the first; if that be true, what becomes of the boasted strength of our American civilization?

MORRIS LOEB.



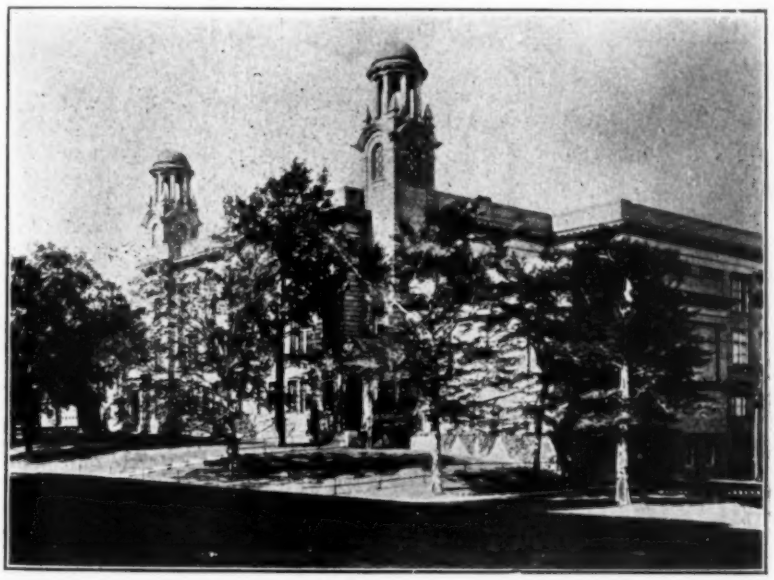
THE MAIN BUILDING OF THE UNIVERSITY OF TORONTO

THE PROGRESS OF SCIENCE

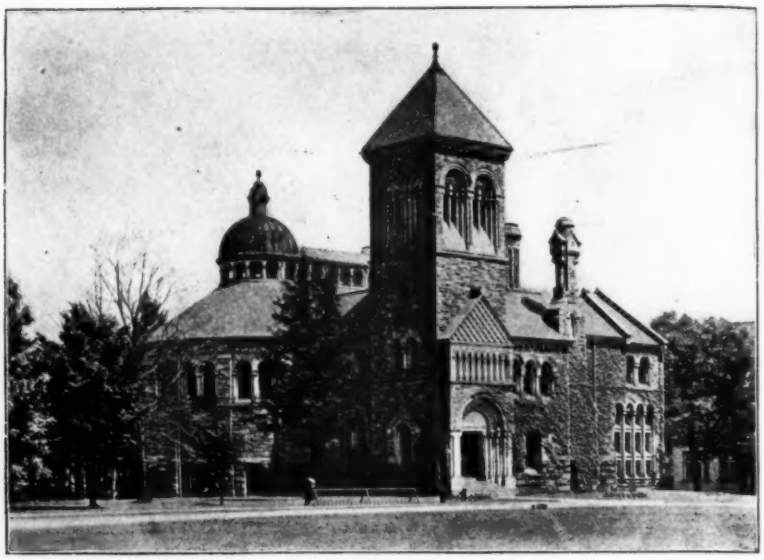
THE BRITISH MEDICAL ASSOCIATION AND THE UNIVERSITY OF TORONTO

THE British Medical Association held its seventy-fourth meeting at Toronto, beginning on August 21. There were in attendance about 1,400 British and Canadian members of the association and about 600 visitors and guests from the United States. In addition to some 300 members from the British Islands, there were delegates from India, South Africa and other widely separated parts of the British Empire, and several scientific men from the European continent. The meeting had thus many of the advantages of an international gathering, without the polyglot confusion. Dr. R. A. Reeve, dean of the Medical Faculty of the University of Toronto, made the presidential address, and there were addresses in medicine, by Sir James Barr; in surgery, by Sir Victor Horsley, and in obstetrics, by Dr. W. S. A. Griffeth. The sections covered dermatology, laryngology and otology, medicine, obstetrics and gynecology, ophthalmology, pediatrics, pathology and bacteriology, physiology, psychology state medicine, surgery and therapeutics. As usual in British scientific meetings, the social features were prominent, and the excursions numerous and well arranged.

Not the least interesting part of the meeting was the opportunity of visiting Toronto and its great university. The movement which ended in the establishment of the University of Toronto was initiated in the eighteenth century, but the institution, which was originally called King's College, was not opened until 1843. Numerous

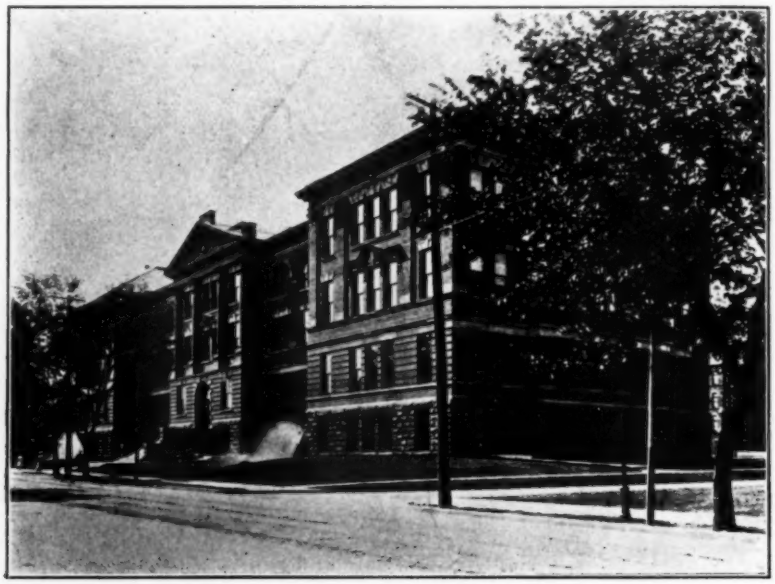


THE NEW MEDICAL BUILDING.



THE LIBRARY.

changes in organization took place, and other colleges were established, which have since been affiliated with the university. It is strictly a state institution, but has entered into wide affiliations and has received large private gifts. Several of the buildings of the university are shown in the accompanying illustrations. The main building, which was the headquarters of the association, was completed in 1858, but it was partly destroyed by



THE NEW SCIENCE BUILDING.

fire in 1890 and rebuilt with important improvements. The new medical building was opened three years ago. The university library, erected almost wholly by private subscription, was completed in 1892. The chemical building was first occupied in 1895, and a new building for applied science was used for the first time by the section of state medicine.

THE NATIONAL PURE FOOD LAW

THE McCumber - Heyburn - Hepburn federal food and drug law goes into effect on January the first. It includes in its provisions all substances intended for human consumption. It is the most comprehensive measure ever enacted by congress for the control of interstate industries. Its provisions apply to the District of Columbia and to the territories, to exports and imports and to interstate shipments. To receive full benefits from its operation, it will be necessary for each state and city to maintain cooperative inspection over its own commerce, for the law will not apply to adulteration and misbranding practised wholly within the state.

The enforcement of any law depends upon evidence. For this reason it is difficult to enforce laws against industrial combinations and discriminations because the evidence of violation can only be had through a knowledge of the inward transactions of the interest. In enforcing the food law the secret schemes of a board of directors or a manufacturing manager will be at once liable to detection by an examination or analysis of the product put upon the market. The profession of chemistry is well equipped with means for detecting adulteration and misbranding. Methods of analyses have already been established beyond dispute, and a wide and accurate knowledge of the standard qualities of food and drug substances has been compiled. In enforcing this law, however, the effect upon health of the use of minimum quantities of antiseptics, like benzoic acid to preserve such fruit and vegetable condiments as are left open in the bottle or jar by the consumer until used up, will be controverted. Some manufacturers began in an experimental way several years ago to put up these goods without antiseptics, and several of the large firms announce that the antiseptic is no longer necessary if the product is properly sterilized and packed in a small package. Others contend that an immediate prohibition of antiseptics will destroy their business. This is one of the honest problems in the enforcement of food laws, and several of the states have found a good solution for the present in requiring plain labeling to show the name and the amount of the antiseptic used in preserving catsups, sweet pickles and similar foods. This labeling puts a competitive trade influence to work which is more effective than prohibitive statute law.

Some provisions of the law will come in conflict with previous laws enacted by congress relating to special products. Under the general law the term 'butter' would mean the unadulterated fat from milk or cream. A previous federal law, however, permits the unqualified term 'butter' to apply to milk fat which contains 'added harmless color.' Again, under the food law the term 'wine' would be defined to be the product made by the normal alcoholic fermentation of the juice of sound, ripe grapes, and 'sweet wine' would mean wine made sweet by arresting alcoholic fermentation. But a previous statute defines sweet wine to apply without added labeling to a product containing added cane or beet sugar. There should be no objection to the sale of butter containing added harmless coloring matter or wine containing added beet or cane sugar. But the interests in whose behalf these definitions were incorporated in the federal statutes wish to continue these colorations and additions

without having to so inform consumers. This is wrong.

It will remain for the courts to adjust the conflict between such statutes and the general food law. The law itself contains an omnibus joker, intended by its friends to exempt certain practises of adulteration or misbranding from the other strict but fair provisions relating to deception by artificial color and to misrepresentative labels. This joker appears in the last paragraph of Section 8, in the definition of the word 'blend.' But it can be safely conjectured that when the act goes before the supreme court this paragraph will not be construed out of harmony with the other strong provisions.

A committee consisting of H. W. Wiley, chairman, from the Department of Agriculture, S. N. D. North, from the Department of Commerce and Labor, and James L. Gerry, from the Treasury Department, has been appointed by the secretaries of these departments to formulate regulations for the enforcement of the law. This committee began hearings in New York City on September 7. The various manufacturing interests will be heard, and the state departments have been asked to cooperate in suggesting regulations. At Hartford, Conn., in July, the association of food-control officials amended its constitution so as to include the food-control officials of the federal government, and an arrangement was adopted whereby there will be coalition of the food standard committee from the state analysts and the food standard committee appointed by the United States Secretary of Agriculture. This action will influence uniformity between the state laws and the national law, and bring about close cooperation between the United States Department of Agriculture and the state officials in the enforcement of food and drug control legislation.

SCIENTIFIC ITEMS.

WE regret to record the deaths of Dr. H. Marshall Ward, F.R.S., professor of botany at Cambridge University; of Dr. Alexander Herzen, professor of physiology at Lausanne, and of William Buck Dwight, professor of geology at Vassar College.

DR. A. A. MICHELSON, professor of physics at Chicago, has been elected a foreign member of the Accademia dei Lincei, Rome.—Dr. L. A. Bauer, of the Carnegie Institution, and Dr. John M. Clarke, state geologist of New York, have been elected corresponding members of the Göttingen Royal Academy of Sciences.

AT a conference of the International Geodetic Association to be held at Budapest on September 20, the principal topics to be considered were the accurate surveying of mountain chains subject to earthquake, with a view to ascertaining whether these chains are stable or whether they rise and sink, and the taking of measures of gravity so as to throw light upon the distribution of masses in the interior of the earth and upon the rigidity of the earth's crust. The drawing up of preliminary reports on these two questions has been entrusted to M. Lallemand, director of the general survey in France, and Sir George Darwin.